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A
COMPLEAT BODY
OF
HUSBANDRY.

CONTAINING

RULES for performing, in the most profitable
Manner, the whole Business of the Farmer and
Country Gentleman,

I N

Cultivating, Planting and Stocking of Land;

In judging of the several Kinds of *Seeds*, and of *Manures*; and
in the Management of *Arable* and *Pasture Grounds*:

TOGETHER WITH

The most approved Methods of Practice in the several
Branches of HUSBANDRY,

From sowing the SEED, to getting in the CROP; and in Breeding
and Preserving CATTLE, and Curing their DISEASES.

To which is annexed,

The whole Management of the ORCHARD, the
BREWHOUSE, and the DAIRY.

Compiled from the Original Papers of the late
THOMAS HALE, Esq;

And enlarged by many new and useful Communications on
Practical Subjects,

From the Collections of Col. STEVENSON, Mr. RANDOLPH,
Mr. HAWKINS, Mr. STOREY, Mr. OSBORNE, the Reverend
Mr. TURNER, and others.

A WORK founded on Experience; and calculated for general Benefit;
consisting chiefly of Improvements made by modern Practitioners in
Farming; and containing many valuable and useful Discoveries, never
before published.

ILLUSTRATED WITH

A great Number of CUTS, containing Figures of the Instruments of
Husbandry; of useful and poisonous Plants, and various other Subjects,
engraved from Original Drawings.

Published by his Majesty's Royal Licence and Authority.

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Printed for THO. OSBORNE, in Gray's-Inn;
THO. TRYE, near Gray's-Inn Gate Holbourn; and
S. CROWDER and Co. on London-Bridge. MDCCLVIII.

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and preserving Cattle, and in breeding



To which

The whole Management of the

Business of a Farm, and the

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And, enlarged by many new and useful Communications, as

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COMPLEAT BODY
OF
HUSBANDRY.

B O O K V.

Of the Animals necessary and useful in Husbandry and Farming. In FOUR PARTS.

I. Of CATTLE.

CHAP.

1. *Of the Horse in general.*
2. *Of the Choice and Management of Horses for the Farm.*
3. *Of the Saddle Horse for the Husbandman.*
4. *Of breeding of Horses.*
5. *Of weaning Foals.*
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CHAP.

28. *Of the Cock and Hen, their Kinds and Choice.*
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42. *Of the Advantage of Fish Ponds.*
43. *Of the making of Fish Ponds.*
44. *Of the stocking of Fish Ponds.*
45. *Of feeding, preserving, and taking the Fish.*

IV. Of INSECTS.

46. *Of Bees, their Nature and Products.*
47. *Of the Hives, and the Manner of placing them.*
48. *Of the swarming of Bees.*
49. *Of hiving the Bees.*
50. *Of preserving the Bees.*
51. *Of taking the Honey and Wax.*

The INTRODUCTION.

Of stocking the Farm.

WE have informed the husbandman concerning the nature of his soil, the advantages of inclosure, the use of manures, and the benefit of plantations; and we now advance to the stocking his farm.

When he knows the nature of his ground; and has fenced, planted and prepared it for his undertaking, it is ready to receive his cattle: part of which are to be fed upon its produce, and part employed in the labours of improving it. These are a great expence, and they are expected

pected to yield him a proportionable profit. They are in their nature qualified to do this; but the profit will be greater or less, in proportion to his skill in managing them.

From some he is to have labour, from others food, and from all he may have many occasional, and, as it were, accidental profits. The horse is to save him much toil of his servants, the ox and sheep are to supply his kitchen and the market; as also, the hog: but the home consumption is not all, many of the parts and products of his stock are exported at a great price; and he will be able to make the more advantage, as he is the better informed of every one of these particulars.

He is to consider his cattle with respect to their food, and with regard to their dung: this will lead him to their proper management in the field, in his yard, and in the stable. The methods of regulating their food, litter, and standing, will be a principal object of our attention.

We hope to lead him to a much more beneficial method in several respects than is generally known.

The reader is not to suppose us deficient with respect to those articles, which, although they regard cattle, are reserved to distinct and separate parts of it.

In this place we consider the husbandman as purchasing his stock, and disposing and employing it on his land; after which we are to proceed to the immediate labours to be employed upon it. The several products of his stock in hides, tallow, and other articles are to be considered hereafter; also the diseases to which the several kinds may be incident: for we do not suppose him to purchase one kind labouring under distempers; or to intend the immediate slaughtering of the others. In the present part of our undertaking, we are to consider the creatures themselves; their service, breed, and management in every respect; and the methods whereby they may be rendered most beneficial to him while he keeps them, and most advantageous in the sale, when it is proper he should dispose of them.

We shall divide these animals under four heads, two larger and more important. 1. His cattle and his poultry; and two lesser, but yet worthy of his consideration. 3. Fish; and, 4. Bees.

The two first demand the most careful attention, as on them depends a considerable part of the farmers expence, and his profits; the latter are not so much regarded

as they deserve, especially the article of fish. We hope to be able to set this in so true a light, that the husbandman shall understand it as one of the regular parts of his occupation, and not the least in profit.

BOOK V. PART I.

Of CATTLE.

CHAP. I.

Of the horse in general.

VOLUMES might be written on the horse, and the subject not exhausted: but the business here will be to select from what has been said, that which is to the immediate purpose of the husbandman.

We shall endeavour to separate the useful from the superfluous; and no more to omit any part of the one, than load this treatise with the other. It is not our purpose to consider the horse as the racer, or in the manage, but as the useful servant of the husbandman, who is to buy him for his purposes, with remembrance, that if he can breed from him, sell him at an advantage, or any other way make him produce a certain profit, 'tis all within the compass of his profession. We would no more have the farmer a jockey, than a sportsman; but so much of every branch, as may be useful to himself, without transgressing the bounds of his profession, we would have him know; and so much we shall endeavour to inform him.

The diseases to which this animal is subject are numerous, and many of them little understood. These destroy many a useful creature that might be preserved with proper care; and after all that has been written on this matter; after the innumerable bundles of receipts in old authors, and the discoveries, great as they are, which have of later time been made by ingenious foreigners, as well as by our Gibson, Bracken, Bartlet, and the rest, there is no book in the English language so much wanted, as a complete system of farriery.

It is not within the compass of our undertaking to enter upon this at large, nor is any more than a part of what might be said on it necessary to the farmer; but that part
we

we shall endeavour to lay down, by the assistance of many enquiries, and a long experience, if not in a compleat, at least in a useful manner.

It is but of late the consideration of horses has fallen into the hands of those who had the requisites for a due care of them. Farriers used to be of the most ignorant among mankind; and every blacksmith called himself a horse doctor. Of late the great use of this creature in our various concerns of business and pleasure, has rescued it out of such hands, and made it a subject for more education and abilities; and though the practice be yet far short of perfection, many advances have been made in it, with which the husbandman should not be unacquainted.

So ignorant have the old writers been, that they are continually mistaking the seat and place of the diseases in this animal: nothing is so common, as to see those who know no more of the creature than what they read in those erroneous books, rowelling and burning a horse in one place for a disorder, the seat of which lies in another, which cannot be effected in any manner by what is done: excepting for the cheats of jockeyship, people are as unskilful in every respect; for all that seems to be studied now about a horse is, how to deceive the purchaser.

The diseases of this creature, will be explained hereafter: here we shall endeavour to set the husbandman right with respect to the nature and kind of his cattle, and his management of them in food, and at labour.

Horses, though all of one species, may be divided into many kinds, according to the different services for which they are designed. Those for the nobler exercises, or the uses of pleasure, demand a great deal of care and trouble, as well as large expence; but the farmer's horses, which are for labour only, require little of either.

Let him not take his directions from books, where the principal regard is shewn to the racer, the hunter, or the managed horse: the plain and cheap practice used for the cart horse, and the poorer sort of road nags, is all that concerns him: this he will find here, and let him compare it with the management of his neighbours, to see how it agrees with that, and how it excels it: we would have him learn not only from what he reads, but what he sees; and improve his knowledge from the miscarriages as well as the success of others.

CHAP. II.

Of the choice and management of horses for the farm.

THE husbandman must proportion the number and kind of horses to his farm, and he is to consider the sex. In some cases breeding from them may be a thing of great advantage, and under other circumstances, it may not be prudent in him to think of it.

A certain proportion should be kept up between the arable and pasture land of a farm; but this cannot be always done so exactly as might be wished. The excess in either kind, where it cannot be avoided, will give the husbandman a proper caution as to the sex of this kind of cattle; as the nature of the employment for which he wants them also will.

The horse for plow must be strong, no matter for his shape: but for cart some care should be had in the choice, and in the size. These should be big breasted, large bodied, and strong limbed; and they should be bought of a moderate size, that they may match with one another; that others may easily be got to match with them when any die, or are sold out.

The having horses for slow draught all of a size, or nearly so, is a considerable article: for otherwise the team never work equally, nor at ease to themselves. The husbandman has not the advantage of half their strength, though they go through an equal fatigue: the tall horses hanging up the low, and it being altogether impossible they should draw evenly together.

It is a benefit in the horse intended for this service to be sluggish: the fittest for it are such as require the whip, rather than such as are ready to draw more than needful.

The farmer should avoid that common fault, the making one horse serve for different uses. Let him never put a saddle upon his draught horses, for it alters them in their pace, and renders them awkward and troublesome in their proper labours.

In regard to the sex, he is to be directed by the nature of his farm, and the proportion of one kind in his land to another.

Mares are more profitable than horses, because, beside their labour and service, they yearly will bring forth a colt,

colt. But let not the young farmer resolve at once, for this reason upon the buying that sex. If he have a great deal of pasture ground, in proportion to his arable, he will do right to stock himself with mares; but where the arable is the greatest quantity, it will be more to his advantage to have horses.

In some counties the farmers in general purchase mares, and in others they in general keep horses: this is founded on what they find answer best, because their lands are so disposed. In some counties the arable is over-proportioned to the pasture ground; and these are the places where they keep horses mostly; in others the pasture ground over-balance the arable, and these are the places where the run is upon mares.

When the nature of the farm recommends it to the husbandman to purchase mares, it is of more importance to him to consider their shape: because on that will, in some measure, depend the value of the breed.

Let him chuse mares with a good forehead, the neck, breast, and shoulders are to be his principal regard.

Let their body be large; for it is a great advantage to the foal to have room, while it is growing.

The foals the husbandman shall have from mares thus chosen, will pay him for his care: they will generally be well-shaped; and it may be worth his while to sell them at about six years old.

Let him not think that the keeping them to this age, is any hardship: their work, the greatest part of the time, will pay for it.

Where the husbandman has not the advantage of breeding, it is worth his while to buy colts young, and train them to that age for sale. This is practised in many of those counties where the arable in general exceeds the pasture.

The husbandmen of Hertfordshire buy foals out of Leicesterhire, which is a good breeding county, to sell again to an advantage. They purchase them at two or three years old, and sell them at six. The foals improve every year; their labour answers for their keeping, and at the end of this time they are fit for coach horses, and are commonly sold in London for that purpose.

In some counties horses are much required for carriage of loads, packs, panniers and the like. When the husbandman wants a horse, for this purpose, let him chuse him of

a stout make, but not tall. Let him have a broad back, out ribs, full shoulders, and thick withers. This is a material circumstance, for an horse that is thin in that part is always galling.

Let him next observe his going: that horse is best for this service that takes the stoutest and best stride: he is neither to trot nor gallop: all his business is a foot pace; and the horse that takes the largest step, goes evenest and rides ground fastest.

The horses being thus purchased, the next thing is their management; and this is very easy. They are destined to coarse service, and they require nothing of those pampered methods which are needful to the fine horses, rendered delicate by idleness. They require no walkings, or nice dressings, but what they do want let the farmer see they have duly and regularly.

Let them be well dressed, and their bellies well filled: for otherwise they will never be able to go through their tasks. Beside this let their shoes and their backs be constantly looked to, and little or nothing more is necessary.

Let their food be sweet hay, or of other common kinds single, or mixed, according to convenience: once in a week or ten days let him give them some warm grains and salt. This will keep them in health: for they will escape most of the common disorders, by their constant exercise and labour.

If bleeding appear requisite, spring or fall is the time, or both. If there be danger of any disorder about his head, it is good now and then to burn a little frankincense under the horses nose, when he is about to lie down at night. In the heat of summer it is very good to take a labouring horse into deep water, and swim him now and then.

It will do no horse any harm to be bled every spring and fall; but if once this be made a custom, let it be regularly observed: for as sure as it is omitted he will have some disorder. Nature expects these artificial discharges, if they have been brought into a custom, as regularly as if they were her own, and can no more do without them.

A fat horse should drink often, and but a little at a time; but if he be lean let him drink as he pleases.

Rubbing does a great deal of good: and every horse likes it. A horse should always be turned to grass once a year;
for

for it cools his blood, scours off foul humours, and prepares his stomach to receive full nourishment from his other food.

CHAP. III.

Of the saddle horse for the husbandman.

WE have cautioned the farmer, not to put a saddle on his labouring horses; therefore, as his occasions will take him frequently on horseback, he must keep one for that purpose.

The horses bought for this use, may be serviceable on other occasions: the draught, or load horse, must not be taken from his work, because it spoils his pace, but there are many little services for which the saddle horse will do, when he is not required for that use: and it will do him no sort of harm to take him to them as necessity requires.

Let the husbandman get one of as good a shape as his price will afford; for it is a general rule that the value of a horse for the road may be judged by his form.

His head should be lean, his eyes prominent, or full, and his neck well raised. Let his chine be well risen, his joints strong, and his pasterns short and strait, and so strong as not to bend in his going: and let his hoofs be sound, tough, and hollow.

Let him examine also his temper and disposition. He should be moderate: too dull a jade is as bad as a run-away. The husbandman wants his nag for service, and let him chuse him such as will do his business freely, without continual whipping; and yet not be eager to go on when there is no occasion.

This care taken in the buying, the next concern is feeding him. His food should be fine hay in winter, and sweet grass in summer; and to these are to be added dry oats, beans, pease, or bread, according to his occasions.

Let him be watered two hours before he is taken out to ride, and rubbed, dressed, and fed; and after this let him be bridled up, and stand an hour before he is mounted.

At setting out on a journey, travel moderately in a morning, till the horse be warmed, and then encrease the speed as occasion requires.

At night he should be watered two miles before his journey's

journey's end ; and then brought in warm : set up in a warm stable, and well rubbed and littered.

Let him have no meat while he is in a sweat in any part, but when dry let him be rubbed and fed, according to his stomach and his duty.

If the road horse wants appetite, change his food, for these creatures love variety as well as our-selves ; and will often be tempted to eat new meat when they would not have touched the old. If this do not answer, let there be a small quantity of white wine, salt, and vinegar mixed together, and let his tongue and nostrils be rubbed with it. This seldoms fails to recover his appetite.

Let the rider look well to his back and to his feet. Let him see that the saddle does not gall, nor the girts pinch him ; and that the shoes be large enough, and that they fit fast and easy.

The less he is used in long journeys, the less of this strict care is necessary : but let it be proportioned to the duty. 'Tis always well to know the whole, and too much care never did a horse harm.

C H A P. IV.

Of the breeding of horses.

WHEN the farmer is situated in a good breeding country, there is nothing which he can practise to more advantage, both for his own service and for sale.

We shall lay down such rules as may be necessary in this matter, and although the immediate purpose be breeding of horses for the service of the husbandry, yet as the farmer may sometimes step a little beyond these bounds to his advantage, we shall not so exactly confine our instructions to them, as to discard totally the rest.

The first consideration, is that of the ground, for though he lives in a good breeding country, every part of it may not be suited alike to that use.

The ground proper for breeding of horses is of a middle value, between the best and worst. Horses are a very valuable commodity, but let not their price tempt the husbandman to enter rashly upon this design. They are subject to many casualties ; and at best are a long while in rising to their

their value: let him consider whether he cannot make greater advantage of his ground in the common way of his employment, for it is very likely he may. If it appear that he can, then his land is too good; and he should for that reason drop his design: on the contrary, he may be possessed of grounds, which as they will not produce much any other way, so they may not be rich enough for this. In that case he is also to drop it. In the one instance it is not worth his while; and in the other he cannot accomplish it.

The condition of the grounds which should tempt him to have mares for the sake of breed, is where the pasture land bears an over-proportion to the arable: but a certain condition in this pasture ground is also requisite. The proper pasture for breeding these creatures is of a middle nature.

It should be such as yields a short grass, but in good quantity: and it should be high rather than low; and the soil must be such as has some firmness, for its being hard under foot is an article of great advantage. We would not be understood that no other will do, but this is best.

There must be good water; and if it be full of mole hills, and other uneven places, it will be the better, because it will use the colts to tread firm.

Good air is a great article also in a breeding ground: if it lye on an elevated situation, this will probably be the case: and further, it will be needful that there be good shelter.

Inclosed grounds are best for breeding, because they are warm and defended; but open and common land may be used; only the husbandman must be the more careful to provide convenient shelter; and must be more than ordinary careful of the mares just about the time of their foaling, and of the young while yet tender.

When he has a considerable quantity of land that he designs for this purpose, it should be divided into several pastures.

The poorest are for the stallion to run in with the mares: the most under shelter are to be kept for the mares to foal in: the fruitfulest and richest are to be reserved for them while they are followed by their foals, and give milk: and lastly, for the bringing up of the colts after they are wean'd, the largest, openest, and the most uneven ground is best.

According to the use for which the colts are designed,
let

let the stallion and the mare be chosen. We have directed the choice of mares for husbandry : for any other use they are to be selected with regard to that particular service.

The stallion is also to be chosen according to the intended service. The Turkish is an excellent kind for a horse intended for the wars : the barb is the best for racers ; the best for hunting is the bastard barb begot of the English ; the best for the coach is the Flemish ; and the best for travel, draught or burthen, is the English.

These are rules long ago laid down, and since that time often disputed ; but they are nevertheless maintained with reason by the most experienced to this day. Fancy and opinion so far prevail at this time, that it is scarce possible to find two people who will not dispute upon this subject. However, he who observes these directions will not repent : for serviceable horses for the husbandman, the right English is the stallion, beyond all dispute.

The best season for putting the stallions and mares together is the middle of March, and the stallions should be taken away again in the beginning of May. The time of foaling is of great consequence : for the foal that falls in March is much more profitable than that which falls in May, having a part of the cold of that season, and the whole ensuing winter to harden it. The colts foaled in March stand better, and are less liable to accidents than those later in the year.

The farmer must have his pastures in order for receiving his horses and mares : but he must observe not to make his mares too fat before the time of their running with the stallions ; for they conceive better, and hold better when they are in but ordinary case.

He should give the mares three weeks rest from labour after their conceiving : but after this they may be employed in the common affairs of husbandry, not working them too hard. The farmer may, without any damage, keep them to work till the next spring ; and then he should let them run loose till they foal.

This is the best method for mares that are breeders, but every part of it is not absolutely necessary to be observed. If the farmer's affairs require, he may have more work out of them ; but if he allow them so much rest, they will do the better.

When the mare has foaled, she should be removed into the best pasture he has, for this will make her have plenty of
of

of milk, of a nourishing quality. The pasture must also have sweet water and good shelter, especially if the foal have fallen early: and the mare should take care of it a good part of the summer, or the whole summer, and following winter. There is a notion the winter's milk is not wholesome, but that is a weak and idle fancy. The farmer is to suit all this practice to his other affairs, but of this he may be sure, that if he can allow of it, the foal will be the stronger for running the whole year with his dam.

The foal will partake of the nature of both parents, but most of the mare.

Both the stallion and mare should be sound, if healthy colts are expected, for they will partake of the diseases of their parents in both sexes.

The way to have large colts, is, to chuse large bodied mares, and to feed them well during the time of their pregnancy: very large foals have been thus produced from small stallions.

A great deal of care should be taken to keep the mares tame, and to make the colts also at first tame: the mares often injure them while in their bellies, by leaping hedges and ditches; and the foals damage themselves while they are young by their unruly frolicks. A good way of keeping the mares gentle, is by giving them daily some work, for this accustoms them to be tended and handled; whereas when they run free the greatest part of the time, they are difficult to be kept in order; to be removed from one pasture to another, or to have the foals properly tended.

Great nicety is used in breeding horses for the finer employments; but 'tis the husbandman I am directing, and he may in this manner avoid the trouble and expence of housing his mares, and all that ceremony commonly practised. He will often have better foals thus than those who observe the most exact rules; as we frequently see the children of ordinary people more healthy and strong than those of quality.

The age of a mare for breeding is from four to twelve years old, if she have been employed in the common labour of husbandry during the time; but if she have been kept for breeding entirely, she may be held to it a great many years longer.

The age of the horse should be from five years to fifteen.

When mares are kept altogether for breeding, it may be proper to bestow more care upon them. It is a good method,

method to feed them richly for a fortnight before their foaling, which will give them strength, and plenty of milk : it will make them ready also the quicker to take horse again.

Where a mare is thus managed, she may be led to the stallion three weeks after foaling ; and her foal may run by her till she comes again.

CHAP. V.

Of weaning foals.

THE common practice is to wean a foal at about six months, when that falls out toward Michaelmas, or else about six weeks before the dam foals again, provided that happen in a good season ; but we rather advise the farmer to let his colt run by the dam till she gets another ; and in this we are supported by very profitable experience : the colt which has run the winter with his dam, is in general stouter and more healthy than such a one as has been weaned at the approach of winter, whatever have been the care taken of him.

The weaning a foal at whatever age is an article of consequence ; and upon the proper conducting it depends in a great degree his future value. If care be not taken in weaning, and in the summering and wintering the colt for three years afterwards, he will never be worth nearly what he might under the right management.

The colt should be taken from its dam over night, and driven into some warm and sheltered place out of her hearing : it must be fed carefully in the morning ; and from that time thoroughly attended for four or five days : it will then have forgot the dam ; and may be turned out to take its chance : but care must be taken to keep it out of hearing of the mare for that whole summer, after which there will be no need of any particular caution.

Such as are intended for gelding, should be cut at the time of their weaning, and then the same care serves : and as soon as those few days are over, the part will be healed ; and will occasion no farther trouble.

After this the colts should be separated from the fillies, and each parcel turned out into some open pasture where they may have room, and a free good air ; here they run at liberty till they are fit to be broke for hand.

Some

Some geld their colts younger than we have directed, and when that can be done with convenience, it is as well. They do it while they suck, as soon as the testicles come down: sometimes gelding them at a fortnight old.

When it is done at this time, there seldom are any bad accidents attend it: all the damage that appears the other way is a little swelling of the parts; and this goes down when they have been kept carefully three or four days, which is what we have advised to be done on account of their weaning.

The two methods are so little different, that the husbandman may follow which he likes best; but if he come to a resolution in time, the doing it while the colt is very young, and is sucking, is preferable.

For whatsoever service the husbandman intends his breed, and whether he raise fewer or more, it will be of great importance to observe these directions, relating to their breeding and weaning: we have made it as little troublesome as possible; cutting off all that experience has shewn to be superfluous in the common practice; but the little that is here ordered, he is to observe carefully.

C H A P. VI.

Of the breaking horses for service.

IN many things the greatest advantages depend upon what appear to be small matters, and it is thus in the case before us. We have given the husbandman direction for breeding his colts; but he is yet to take the care of breaking them; and although this is sufficiently regarded in horses of the finer kind, no article of husbandry is so shamefully neglected, as the proper care of first training the horse to his several services in that employment.

One common fault is, the neglecting to break them at a proper age. The sparing a little trouble at a right time, is the spoiling many a good horse.

The colt that is expected to turn out serviceable should be broke early, and used gently at first. The common custom spoils a saddle horse, by making him do too much as soon as he is broke, and the usual destruction of the draught horse for meaner service is the not breaking him in time.

A year after the colt has been turned loose from his weaning,

weaning, let him be taken up and gently and gradually tamed. Let him be used to the hand for another year; and when he is three years old, if he be for the saddle let him be backed; or if he be for draught or burthen let him be broke to it. Whichever be the case, let it be done gently and gradually. Let little be required for the first year; and more the second, but in moderation.

The saddle colt should be little more than walked the first year; and seldom carried beyond a trot the second; after this there will be no danger of spoiling him, except by unreasonable usage. Let the colt be taken up at the same age for labour in husbandry: but the first year let him draw but little; and the second advance his labour moderately: thus he will by degrees be trained to know his strength, and how he is to use it.

Gentle exercise an hour a day is enough the first year; and two or three hours a day the second. The horse does not come to his strength till six or seven years old; and he never thoroughly comes to it at all, if he be too hard wrought while young.

There is no time nor service really lost this way; because the horse will stand serviceable many a year the longer for this care at first: he gets doubly at the end what he loses in the beginning; and all the time of their service the cattle are stouter, and do so much more.

How long a horse will continue serviceable is a point not yet determined; nor indeed can fairly, except due care were taken of them at first; but as to their length of life, it is more than people imagine. Dr. Plot, chap. 7. page 37. of his history of Oxfordshire, mentions no less than three horses that he had seen in that county of about forty years old; and the late Duke of Montague had one which was confidently reported to be not much less than fifty. It had been kept without labour several years; but did not seem to have been a great many years past service.

When the colt is first taken up he will often be sullen and unruly: and it is a neglect at this age that makes the horse vicious all his life. He must be brought to gentleness by hunger. Let him have no victuals but what he takes out of the hand.

If this do not answer let him be kept waking night after night: the most unruly horse while young, will be rendered tractable in this manner.

Use

Use the colt to gentleness while he follows the dam, by giving him good food from the hand: this will take off that natural shyness and fierceness which there is in every horse, till made gentle by use.

A great time of a colt's growing unruly is, when he is first backed, or first brought to draw. In either case make him go in company of other horses. When he is first rode let it be gently, with another horse before him; and in the same manner, when the husbandman first puts him to work, let him not be set to draw alone, but with others, and let his task be easy and short.

The colt that would fly out, and do himself or those that worked him a mischief, if he were employed alone, or set to an heavy task at first; when the business is easy, and he sees others of his own kind about him, soon submits; and is easily led from the lighter to the harder, and finally to the hardest duties.

CHAP. VII.

Of the number and working of horses.

AS the husbandman is to suit the sex of his draught cattle, to the nature of his ground: he should also consider their kind and size: that sort of horses may suit with one farm, which will not do well upon another.

Richness of the pasturage, and the size of the cattle, are to be proportioned to one another. He who has rich ground should breed large horses, for they will every way be most advantageous; and he whose land is poor must content himself with a smaller sort.

Horses must be well fed, if they go through a great deal of work; and large horses will never be fed sufficiently upon poor pastures. It is not easy to say what number of horses will answer the husbandman's purpose, for any quantity of ground. This has been attempted, but the differences between one kind of land and another, in the degree of labour they require, makes it impossible to determine with certainty. In land of a middle sort, one horse to ten acres will answer the careful and skilful husbandman's purpose: but he that wants knowledge and management, may use twice as many without doing half the business.

When the number of horses has been settled, the next care is the proportioning the work among them.

The young ones are to be worked gently: they may be continually kept doing something at the harvest, seed time and fallowing. There are sufficient articles of drudgery in the farmer's business, and these he is to throw upon such horses as will never be worth any thing by sale. He is to keep a proper number of these for hard work; and though they be aged or blind they will answer his ends, provided they are well fed. The slight work of the others, accustoms them to their geers, and makes them bring the better profit upon sale.

The husbandman who buys young colts, in order to sell them again, must take care in the choice: for such as they are, such they will grow up: and he who breeds must be careful of his stallions and mares, otherwise he may be greatly disappointed, when he comes to the sale. With due caution there is hardly a more profitable article, for there are always purchasers for them, and the price, if they be well chosen, is considerable: but I have often known the husbandman, when he has taken a good number of them to the fair, forced to sell them for little, or to keep them on his hands.

Blindness and other accidents will happen to horses ever so carefully bought, or bred; but all dealings admit of some accidents: we do not pretend that of horses is more exempt from them than the rest; on the contrary, it is perhaps as precarious as any; but the more uncertain of success it is, the more ought the causes of that uncertainty to be watched; and the more needful is a strict observance of those rules which may prevent the losses that often attend upon it.

As the horse is the first and most considerable of all the animals that are of service to mankind, the strongest, swiftest, and most generally useful; it is a creature that will naturally be of certain and ready sale: the variety of uses in which he is employed, will make a demand for all kinds, and those of all qualities. 'Tis therefore an article of so much profit, and so naturally and commodiously in the way of the husbandman, that he should never be deterr'd from it, by possible losses. His profits will be certain, including all things, and the degree of them will be proportioned to his skill and care.

By skill we do not mean that of a jockey, which is rather artifice and cunning. It is unworthy of an honest man; and it would take off the farmer from his more useful studies.

studies. We mean by skill nothing more than a knowledge of those plain and general facts, laid down here in few words; and by care his keeping that knowledge in mind; and acting according to it on all occasions.

C H A P. VIII.

Of the turning horses to grass, and taking them up to the stable.

THE proper time for the giving the husbandman's horse green food, is in the beginning of May, and the time for taking him up is toward the end of August.

In Buckinghamshire, and the neighbouring counties, the custom is to turn out the draught horses in the middle of May, into their enclosed fields of clover. This is a rank food, but it gives great strength and heart. The beast does his business in the laborious articles of husbandry, more constantly and freely upon this grass than any other; and experience shews that he is less liable to colds, and many other accidents, than when fed on the finer kinds.

Let the horses be turned out first in the heat of the day: and if it be a wet or cold season, take them in at night, till it is more favourable.

Work them as usual, while they are at grass, taking them up in the morning, and giving them a moderate feed of corn and chaff, two hours before they are collar'd; and repeat the same after they come from work. This keeps them in great heart; and somewhat dries the green and moist food in their bodies.

In Hertfordshire it is a practice to turn the cart and plow horses into a field of green vetches, fettering them if there be occasion; this is a very strengthening and wholesome food.

In other places, fresh food is given the horses in racks. They mow the clover, vetches, or the like, in small quantities, as they want it. Lucerne and saint foine may be cut in the same manner with great advantage.

Another good method is to sow some ground purposely for this use with the three seeds of clover, ray grass, and common trefoil; and cut it fresh for their eating in the racks. This keeps them fresh and in good heart, under the tightest duty. In these several methods also, by the

help of straw, there is a great deal of good dung made for the service of the fields.

This fresh cutting of clover, vetches, and the like, may be practised in vale ridge half acre lands, as well as in chiltourn inclosed fields; and is attended with great advantage.

Let not any suppose us deficient, because we do not lay down the methods prescribed in books, and practised by jockeys, of bleeding the horses, and all their other practices upon the change of food. It is idleness more than the alteration of the diet, that causes the disorders into which horses that are bred for finer services fall, at these seasons. The husbandman keeps his cattle to their labour; and if he does this rightly, it will answer all the purpose of bleeding and drenches.

In common field lands the horse is staked down with ropes, where he is put to eat the grass: where this cannot be avoided, the farmer must be content; but it is a sorry method. The creature is necessitated to drop his dung and urine on the grass; and he will not eat it immediately after. The remedy is frequent removing of him, for he will eat the spot on which he dung'd after a little time, though he will not while the taste is strong in it.

A horse may be staked not only on a piece of grass in a common field, but also on a piece of green vetches, and will thrive upon it very well: but there is the danger of his breaking loose in these places, and in that case he generally does a great deal of mischief.

In the sandy parts of Norfolk, they sow turneps for the summer food of their horses, and other cattle. They give it them in the manger, sometimes in the field; and it answers very well either way.

They sow a particular kind of turnep for this use, known by the name of the yellow turnep. The seed is sold at every seed shop. They sow it in March, and the turneps are ready to pull at the end of May; and they continue sowing again and again once in six weeks, for a constant supply, till the latter end of September; in all which time it keeps the cattle in excellent heart, and enables them to go through their work equally to any food whatever.

In these counties, they have a custom of spaying their filly foals. They do this at a month or six weeks old, while

while they suck, and it is attended with no danger. The mare becomes a particular, and a very useful creature; grows large and very strong, and in general is preferable to a gelding.

The only inconvenience these mares are liable to is overgrowing at the joints, which sometimes makes a weakness in those parts; but this may be, in some degree prevented, by spaying them when they are a little farther advanced in their growth. A very good time is just when they are taken from the dam, when that is done at six months, for the cutting heals while they are under the care of the weaner.

At the approach of winter it is the custom to take up the horses, because the grass becomes short, and the season cold: but the condition of the creature ought to be the rule for this, more than the month of the year. So long as he can well endure the weather, and the food answers for him, he will be much better in the field, than in the stable: and the saving the expence of stable food is no trifling article.

It is a good method to moderate between the two, by taking them into a stable at nights, and turning them out by day; as the season may require.

Another way of moderating the matter may answer very well, in the following manner. Let a number of hovels be built in the yard: their shape to be a long square, the front and ends open, and the farther side boarded up; and the top covered with furze, or other cheap stuff. Against the boarded part are to be fixed the mangers; and the horses are to have access to these when they like. Thus they run loose, or are under cover as they chuse; and when oats are given them they feed dry: this does not make them tender like keeping them in the stable; and is excellent for preserving their feet, and keeping them in health and heart.

The horses in this management, are not to have liberty to run farther than about the yard, because their dung would be lost: whereas, in this way, all is saved, and the horses escape the confinement of the stable.

As to the feeding the husbandman's horses, the best way is this.

In winter let those who have the care of them be up at five o'clock; and in summer at four; and let them bait their horses. Mix split beans, bran, oats and chaff, or

else mix oats, bran, and chaff only; and give them a little at a time, dressing them while they are eating. Bran is a very necessary ingredient, because it makes the chaff go down, and some give it all the year, accounting that it saves corn, and does the horse sufficient service.

Half a peck of oats may be given in the morning before going to plow, and the same in the afternoon: or after they have baited a little while in the afternoon, a little hay may be given them, and they may be led to water. This is a good method where a horse seems to want a right appetite, for they never fail to eat after it freely.

Chaff mixed with the oats is useful upon these occasions, and a little being given at a time, the creature eats it the more heartily and freely, and it digests the more perfectly.

Whatever method be taken, let the husbandman be sure his horse has food enough: for, whatever he withholds in this respect, is to his own damage. He suffers more by it than the horse; for the creature cannot perform his work well, nor will he be fit for sale unless to a great disadvantage. Many a horse has been reduced half his value, by the saving a small proportion of that charge in his food; this is frequently in other instances also the effect of foolish frugality. I shall recommend the husbandman in all things to oeconomy, but let it be under the guidance of prudence. I have advised him to spare no expence in manuring his lands, because the crop will be sure to repay it; and in the same manner he may be sure that good feeding of his cattle will be paid him doubly, partly in their going thro' their work, and partly in their improvement for sale.

C H A P. IX.

Of the ass.

THE ass follows the horse in this place, not as the next in value, for he bears no proportion to the horned cattle; but because he approaches in some things to the nature of the horse, and is employed in the same kind of services.

The ass in London is the most to be pitied of all creatures; and in many parts of the country he does not fare much better. He endures great fatigue, and his patience is as a virtue. This is a creature that may be made more

useful

useful than it generally is; and that deserves much better treatment than it commonly meets with.

A French author has written a treatise, to prove that the ass is the most useful to man of all animals; he founds this assertion upon its doing a great deal of business, and being kept at a very small expence. But although we shall not altogether agree with this writer, yet we may with reason endeavour to set the creature upon a more respectable footing with mankind, than that wherein he usually stands.

The ass may be purchased at a small price, as well as kept at a small expence, and is therefore a useful creature to such as want the labour of such an animal, and have neither money to purchase a horse, nor food to support him.

The ass will do a great deal of work, and will bear all sort of inconveniencies. He endures fatigue, heat, cold, hunger and thirst better than any creature. He is liable to very few disorders; is very long liv'd; and retains his strength and abilities for doing service to a great age. All this should recommend this creature to the poorer sort of husbandmen in the strongest manner.

He will live upon a common be it ever so barren, a whisp of straw is very acceptable food: he will crop briars and thistles; and chaff is a treat to him. A little more care might be afforded him than is generally allowed; and he would repay it with very large increase of labour.

No creature is better suited to carry burthens: it will also raise water in deep wells, and work in mills full as well as a horse, and will not stand the owner in near the expence of the very worst of that kind.

Asses draw burthens of sand in a sorry kind of carts, ill-harnessed, ill-tended, and under every possible disadvantage. No doubt the husbandman, who would give them tolerable tendance, would find his account in it in many kinds of carriage.

The ass may be made to answer the purpose of the horse in plowing, especially in light lands: and every saving to the farmer being so much gain, here would be a very considerable profit: for the worst horses must be fed at a considerable expence, to enable them to go through their labour.

The she ass has a particular value on account of her milk, which is prescribed by physicians for many disorders; and in London brings a large price.

The inconveniencies are principally three: their slowness, their stubbornness, and the damage they are apt to do among trees.

Their slowness is a fault they can never be expected to mend, for it is in their nature: we are to take creatures with their natural imperfections, and this is that of the ass; but those faults are generally attended with advantages, as this in particular very plainly is. The slowness of this creature being the very thing that enables him to continue so long at his labour; and undergo such lasting fatigue; if his motions were quicker, he would tire like the horse, and other animals.

As to his stubbornness and obstinacy, no creature is so ridiculously stiff when he is provoked beyond his patience; or sometimes without provocation. Something of this may be in nature, as well as his slowness; but a great deal is owing to his ill management. No creature is so little regarded, or treated with such wanton cruelty. He is generally put into the hands of boys, or the worst of servants, who increase his natural obstinacy by their usage.

Let the ass be taken moderate care of; and treated a little like a horse, though it were but like the very meanest kinds; and if he does not become altogether so tractable as that creature, he will lose enough of his natural faults to be rendered very useful; and will fully answer the care that has been taken of him.

It is likely the ass should crop, and sometimes bark trees, for they are his natural food: but it is not particular to this animal. We have given frequent directions for defending young plantations of all kinds from the cropping of animals. The same care that preserves them from others, will keep them also from being damaged by this creature; and where that cannot be done, he must be kept from them.

If any one should take a resolution of keeping many asses, he might, with a little care, prevent this mischief.

Among other benefits attending the keeping this creature, is to be reckoned the breeding of mules, a thing practised to vast advantage in many parts of Europe, and which we have not yet introduced to general practice in England.

As we have recommended the keeping of asses, we shall not leave the subject without giving him directions for their choice.

Asses brought from some warmer parts of Europe, are prefer-

preferable to ours in stature, and for the breeding both of their own kind and mules: when we see one of these compared with one of the wretched creatures of our own country, we must allow the advantage of giving the ass proper care, for they are better looked after in those places; and their excellence is in a great measure owing to that.

Where one of these asses can be had, it is to be preferred; but this is a particular case. I shall suppose the husbandman is to chuse out of such as our own country lays before him: among these let him select such as are bulky, and well squared; such as have large and full eyes, wide nostrils, and long necks. The breast of an ass should be broad; his shoulders should stand high; and he should have a full back. The shortness of the tail is a mark of strength and hardiness.

The best colour is dark; the nearer black, the stouter they are found on trial; and the hair lying sleek, is a good sign of their being in health and vigour.

Let the husbandman chuse a few in this manner, and from these raise a breed.

The best time for covering is in April or May: the end of March or beginning of June will do; but earlier or later than the first or the last of these it should not be.

The best age of the ass for breeding is five, six or seven years: she may be used for this purpose from three years old to ten; but she is in her greatest vigour, and will bring forth the finest colts at about seven.

A stout he ass, and a large bodied she, should be chosen for breeding; and she should be wrought gently toward the end of the time she is going.

These are easy directions; but they will be found of great use: and if the farmer add to this care of breeding them, a very little tending when grown up, he will be able to shew asses, if not equal to those of some other parts of Europe, at least greatly superior to those commonly seen in England; and he will by their means do a great part of his common business as well as with horses, and at a much smaller expence.

CHAP. X.

Of the mule.

AFTER the mention of the horse and the ass, follows the mule, produced between the two, and of a middle stature between them.

The mule has the good qualities of the ass without its bad ones. It is as patient of fatigue, and as capable of enduring hunger, but it is as tractable as the horse; and is sufficiently swift of foot for any common service. When properly bred it is also a handsome creature: and it is indeed so well fitted for so many services, that nothing can be more worth while than raising them.

The mule is often of the size of an ordinary horse, some are sixteen or seventeen hands high. They are strong and sure footed. This is the quality for which they are valued in many parts of Europe, where the roads are mountainous and stony; they will go with the greatest safety, where a horse would break his neck.

They perform well also in draught; and will travel many weeks together with six or seven hundred weight on their backs, without any sign of uncommon fatigue.

The mule is bred from the copulation of an ass and a mare. Those for travel and shew are bred from large he asses and Spanish mares: these are tall and stately, their colour usually inclining to black, and they are very handsome. A larger and stouter kind are bred from the same asses, and large Flanders mares: these are frequently seventeen hands high, and as large set as our common coach horses. They are stronger than horses of the same size, and will bear greater hardships, and be fed at much less expence. At the same time they are much less subject to distempers.

They are fit for the saddle, as well as for these laborious employments: they are very manageable, and walk and trot very easy. They may be suited to the services for which they are designed, by the choice of proper mares, for they take after them. Those for the road should be bred from light made mares; and those for cart, plow, and the like, from the larger bodied and stouter kinds.

There is a substantial reason why we should breed them
in

in England, which is, that such as are bred in colder countries, are always better and longer lived than those in hot. As to their being vicious, it is a complaint only made where there are but few of them, and those ill taken care of; for where they are common, and are treated in the same manner as horses, they are as inoffensive.

Beside the mule already mentioned, which is bred between the ass and the mare, and is a light, beautiful, and lively creature; there is another kind propagated in some places, between the horse and the she ass; but this is an inferior kind.

Foals take more after the nature of the female than the male parent; and the same thing is seen very plainly in the breed of mules: those between the ass and the mare partaking of the nature of the mare, being beautiful, lively and swift; and only inheriting the good qualities of the ass, his patience, strength, and perseverance under fatigue: while those bred from a horse and a she ass, are of the ass kind, dull, heavy, sluggish, ill-made and small. There is very little temptation to breed these any where, because the others may be had with as little trouble. Let the husbandman therefore who shall breed mules, take care he does not fall into the mistake of supposing 'tis the same thing, so one parent be of the ass kind, which of the two it is.

As the mare is to be suited to the service for which the mule is intended, care must be taken to have a proper ass. And above all things he must be large. The fine mules are bred from the tall asses; purchased at a vast price, and from the finest mares. The mare is put into a hollow place railed in, and the ass has the advantage of higher ground in covering.

We see in the mule, the abhorrence of nature to monsters, or animals of mixed breeds. It was once believed, that new creatures were every year produced in Africa, from the copulation of different kinds, and that the increase of those monsters continued: but this is an error; and we see in the mule, two creatures of a different, though like kind, are difficultly brought to copulate; and when they are, although they produce a creature different from either, as the mule; that creature is not able to propagate its kind again.

The mare is averse to receive the ass, and the she ass is unwilling to admit the horse to copulation: where they breed

breed mules frequently, it is a practice to make the ass colt suck a mare: and the mare foal suck an ass, to make them familiar. This has no real effect, but it shews how sensible the breeders of mules are, that those creatures do not go freely and willingly together.

CHAP. XI.

Of the bull, and his kind.

UNDER this head are included, the bull, cow, ox, and calf, each a considerable article in the husbandman's profession. The cow is the principal, though the female, because she is the most universally useful; but before we enter upon her nature and qualities, we shall treat of the bull in his natural condition, and of the ox; as a knowledge of these will best lead to the other.

There are bulls of several kinds, under the name of buffaloes, and the like distinctions: but in England we have only one kind.

Ours differ only in their size, according to the counties in which they are bred. The various parts of this kingdom afford so different pasturage for cattle; that when they are brought into other places, they are called after the name of that whence they came. The Lancashire breed is large, the Welch are smaller, and the Scotch least of all. In Staffordshire they are commonly black, and in Gloucestershire red; and they have the like differences in other counties.

The husbandman should be acquainted with the several breeds, that he may suit his purchase to his land.

The larger kinds are bred where there is good nourishment, and they require the same where they are kept, or they will decline: the poorer and smaller kinds which are used to hard fare, will thrive and fatten upon a moderate land.

The husbandman is to remember here what we have said of trees: they never thrive if transplanted out of a rich into a poor soil: the same holds good in cattle.

The husbandman should have one of these considerations in view, in stocking his land, the using them principally for breed, for milk, or for work: and according as either of these is his principal aim, he is to make his purchase,

purchase: one breed being fitter for one of these uses, another for another.

He must also consider the richness of his pastures, that he may suit the breed to that also. If his ground be perfectly rich, he should buy the largest cattle, the Derbyshire, Staffordshire or Lancashire kind; if poorer he should purchase the Anglesea or Welch, for they will thrive and fatten upon moderate ground.

Whatever breed he chuses, he should keep entirely to it; that is, the bull and cows should be all of the same kind; for it is a general and true observation, that a mixed race does not succeed so well.

We shall now proceed to speak of the bull in general: for the marks of a good one, are the same in all the breeds.

Let his forehead be broad, and the hair upon it well frizzled and turned in small curls. Let his countenance be sharp, his eyes large and full, the blacker the better. Let his horns be moderately long. His neck thick and fleshy; and his body long and large. His breast should be big, his back strait and flat, his buttocks large and square, and his thighs round. His legs should be strait, his joints short, and the hair should lie smooth and even upon his body. This sort of bull answers best for breed. The oxen from him are inclined to be large and strong; and are fit for draught as well as feeding.

Those who are yet more curious in their breed, observe that the ears of the bull be rough within, that his nostrils be wide, and his dewlap thin, long and hairy; that his tail stand high, that his knees be large and round, and his hoofs long and hollow. All this nicety is not necessary to be observed; but if he answer the description in all points it is so much the better. The others before delivered are of great consequence, and the husbandman should observe them strictly.

The breed will partake more of the nature of the female than the male; yet so much depends upon the male, especially in the form of the ox, and most particularly when they breed that creature to labour; that the owner can never be too particular in his examination.

The use of the bull is understood to be only in propagation: in most places he is suffered to run loose, living a quiet life, with no care but his pleasures. This, however, is not necessary. The bull is an animal of strength as well

as the ox, and there is no reason why he should not be employed in the same manner. This is not generally practised, but by an account we have received from a correspondent, who writes nothing but what he has tried, it is plain the practice may be introduced any where with advantage.

To * * * *

“Whereas you have desired me to let you know any thing that should fall in my way in the course of husbandry not commonly practised, I take this opportunity of acquainting you with a use I have found for my bulls.

“You know it has always been my practice to raise more of this kind than others do with such a stock as mine; but I fancy they generally don’t allow bulls enough to their cows; and that the breed suffers by it. Howsoever that be, I keep a larger number, and feeding them seporate, I seldom have any mischief among them. But it came into my thoughts that I might as well have some good of them beside just the breed, and not keep so many large creatures only for that service. Upon this I began to think of setting one of my stoutest bulls to labour.

“This is not a country, where they put oxen to draught: so whether or no they use the bulls in those places for the same work, I can’t tell: but by what I hear, I believe not.

“I tryed one of my strongest bulls first at cart. We had some large timber to carry, and I made them put the bull to the carriage. He was stubborn at first, but after four or five trials he would draw very well. I find him slow but very strong.

“I use him not only in the carriage of timber; but in drawing the clay from the Norfield pit, to the sandy piece you advised me to dress with it, and he will pull a vast load.

“I have tryed to put a couple of them to a cart together, but they do no better than one, for they will never draw equally. One pulls all, and the other lags, or walks easy. I have also tryed to yoke them for plowing, but it does not do. But the first bull that I broke to drawing, works very willingly at plow alone, and I have turned up my heaviest soils with him.



The Pit for breeding Mules.

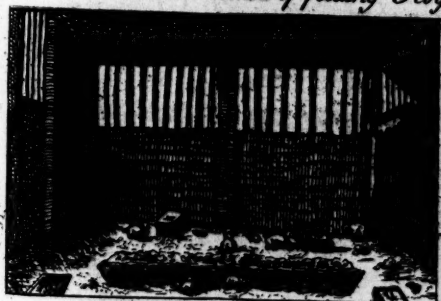
The Bull put to Labour.



The Washing and Shearing of Sheep.



The Method of feeding Hogs without Waste.



*Elevation and Section of the Building for breeding of Rabbits.
Compleat Body of Husbandry.*



“ I write freely what can be done, and what cannot, so far as my small practice informs me ; I have computed all things, and am convinced it would be much to the advantage of husbandry, if bulls were made to work every where. I have been able yet only to make them draw singly, but perhaps, others upon more trial, may bring them to go together.

I am,
your humble servant,

R. G.

It is needless to add any remarks on this plain letter. It is in every ones power to try whether bulls labour answers according to this account ; and, if so, it will be worth while to see how far they may be brought to work together : not that in this case they are of equal value with the ox, who, beside his labour, has his flesh for market : but there is no reason any part of the husbandman's stock should lie idle. The bull feeds and he ought to work. Being properly employed he will not be at all the less fit for his business in propagating the species : rather the fitter.

The diversion of running and baiting the bull at certain times of the year is very old, and has been practised in many parts of the world, and in most at the same season. We had it from the Spaniards, whose bull fights are famous ; and they from the Romans, and the Romans from the Greeks. Julius Cæsar brought it to Rome, and he professedly learned it of the Thessalians. In Greece, Rome, Spain and England, the season for it has always been in the month of August.

The bull is often mischievous ; but it is in a great measure owing to his being kept idle. Many a life is lost in England by this creature ; but if it should become a custom to train them to labour, there would be an end of that mischief. The bull is the only creature of such size and power that is left to himself. If he were worked, partly the labour, and partly being accustomed to mankind, would tame him, and make him as harmless as horses and other animals. They are often naturally vicious as well as the bull ; but it is their being continually in the way of management that breaks them.

CHAP. XII.

Of the ox.

IF the farmers land be rich, let him stock it with the largest oxen that can be raised, for they are much the most profitable.

The Yorkshire oxen are in general black all over, and are a very large, firm and valuable kind. None exceed them for labour, and few will feed like them. The oxen of Staffordshire, are also of this kind. Those of Lincolnshire are in general red and white: they are very bulky, and equal to any in value. The oxen of Somersetshire, and some of the adjoining counties, are naturally red. These are also a very fine, large, and valuable breed.

If he intend to breed his oxen to draught and labour, the black Yorkshire breed is the best: if for market only, Lincolnshire are preferable: the red Somersetshire ox is for either use, and is an excellent kind.

The Lincolnshire breed requires the richest pasture: but none of them will come to their perfection, unless they have very good feeding.

The reader is not to suppose, all the oxen of Yorkshire are black, all those of Gloucestershire and Somersetshire red, or all the Lincolnshire oxen pyed.

These are the genuine breed of each of those counties; but the graziers have mixed them more or less in each, though 'tis best to keep them separate; their kinds and dispositions being particular, as well as the colour.

The husbandman must at first buy, but he is afterwards to breed; and in order to keep up the sort with certainty, he must take care to have a right bull, and well sized cows, both of the same breed. From this stock with a sufficiency of rich pasturage, he will not fail to have either breed in any county.

The ox should be tall, full bodied, short jointed, and well put together in every part, so that one sees their strength. The hair should be fine, and lie smooth.

The strength of the ox is very great, and he has patience to endure fatigue; but he is slow, and must not be put beyond his natural pace. He will not work easily, if this be

be attempted, and fretting and hurrying throws him into distempers.

'Tis but in some parts of England they breed oxen to labour, but it is very profitable. They are to be fed as well as worked; and he who by hurrying them makes them liable to distempers, takes them off from the one, and makes them incapable of the other.

Oxen trained to labour, must be put to work at three years old, but they must be brought to it gently, as a young horse; for if they be pushed at this time, they are spoiled for ever.

Care must be taken to match those well which are to draw together; for otherwise they draw unequally, and spoil the work and one another.

In this regard must be had to three things, their height, their strength and their spirit, for some are tall that have not much strength; and others have a great deal of power that are sluggish.

In general they are tractable and gentle, but regard must be had to their several natures, for they will not be forced out of them; and they may be injured in the endeavour.

The pyed Lincolnshire ox is the fittest for labour. He is naturally long bodied, and till put up to feed, is less fleshy than any of the other good breeds; though he takes to fattening very readily with rest, and a good pasture.

When young oxen are first put to work, care must be taken not to over-heat or fatigue them. They must be suffered to rest in the middle of the day in hot weather, and the servant should give them some hay: this will support them in their labour, better than grass. They must be well fed during the time of their labouring, for they will not do much if they be not kept in spirits, but in this there must be moderation: for there is difference between feeding for strength and for fattening.

An ox for labour must neither be bare, nor fat: in the first case he will be weak, and in the other lazy. They should be treated gently, for they may easier be beaten into sicknesses and disorders, than into labour.

An ox may be kept to work seven or eight years; and in that time he will do the owner a great deal of business; but if ill managed he will be as stubborn as an ass, and will not be fit half his time for service.

Sometimes a young ox will prove stubborn and unruly ; but this will generally be found owing to some bad usage, for the creature has not that bad disposition in his nature. When this happens he must be kept hungry ; and be made to eat out of the hand : when he is brought to labour, he must be tied with a rope ; and at any time when he grows faulty, he must be cherished, and fed with a mouthful of hay by hand ; bringing him by soft means to quietness, and a readiness in performing his business.

For breaking a young ox to the field, single out one of the tamest of the old ones, of its own size ; and yoke them together. Let them be put to some slight work, and suffer'd to do it easily and slowly : they will draw equally, and the young beast will become familiar to it. They will be apt to get into too slow a gait at first, but by degrees they may be spirited to be a little brisker ; and after half a dozen times going out with this quiet beast, the young one must be coupled with an ox of more spirit, that will learn him to go quicker.

This is the only way to get the ox to his speed ; for at best it is not great, nor will he be brought to it by force.

The advantages of labouring with oxen are so great, that it is wonderful the practice does not extend farther. The ox of eleven years old, may be fattened as well as at any other time ; and in the same manner if he fall lame, or by any other accident be spoil'd for labour, at whatever age, he may then be fed for sale.

In this the ox has a great advantage over the horse, which, when aged, or spoiled by accidents, becomes an entire loss, and often a great one to the farmer.

The food of the horse is also expensive, but that of oxen is cheap. They require no oats : and they are little liable to diseases : but though the ox does not require so expensive food, such as he eats must be good in its kind, and he must not be stinted. He must have rich grass to go to, and good hay in winter.

The great use of the ox in labour, is plowing. They will work at this in the toughest ground as well as horses, and do as much in a day. They do not serve so well for drawing of carts and waggons ; and are not fit to be used in places where the roads are good.

The farmer would always do well to train up some of his

his oxen for draught, though it is better not to depend upon them entirely for that service. Every farmer has occasion both for carting and plowing: horses are fittest for the former, and the oxen most profitable for the latter: therefore when there are more teams than one kept, some should be of horses, and others of oxen, proportioning the number to the service. The farmer who keeps only two teams, will almost find it his interest to have one of them of oxen, and the other of horses.

In clayey lands, the oxen are most useful; and in chalky countries least. The chalk soon spoiling their feet.

In some places where oxen are used for draught, they yoke them by the horns, but this is awkward and troublesome. The common way by the neck and breast is preferable.

When the farmer comes to a resolution of keeping oxen for labour, let him provide for a proper supply of them; and see it be rather too much than too little, for it will be more to his profit to sell what he does not want, than to buy for his necessary uses. He should rear at least two oxen and two cow calves every year to keep up his stock; and put his old, or injur'd beasts to fatten and supply their places from this breed. An ox, whether put out of the team for age or injuries, will fatten as well as at any other time, and afford as good beef as any other.

When the husbandman buys in cattle to fatten, it should be in spring, or in the beginning of October. Those which are bought in spring will be fat in July, August, or September, according to the goodness of the soil, and the condition wherein they were bought. An ox that is very forward when bought in, and is turned into a rich pasture, will be fit for market in ten weeks; but there is no need every one bought for this purpose should be hastened to a market condition. The husbandman should suit his endeavours to his grounds, and to the best demand for the cattle: he may keep on fattening the whole summer months, and answer his purpose better for market, and for his land, than if he hasten'd up all he bought, or bought only forward ones.

Those that are bought in at the beginning of October, will be fit for sale early in the following spring. These will fetch a good price; but the winter feeding of them may easily run away with what should be the profit.

The method is to forward them before the winter sets

in hard ; and then only to keep them up in flesh during the hard time, with hay or turnips.

They may be thus kept in a condition for market ; and will be sure of fattening up with great ease very early in spring, to a certain advantage.

Another way is to purchase lean young oxen at that season, which will pay for their winter keeping by their growth, and be ready to fatten up early in spring to full profit.

Another good time of buying oxen for feeding is in August, or the beginning of September. These should be got forward as soon as can be, by putting them into rich pastures ; and they will be ready for the winter sale.

This is the best method he can take, who has rich pasture ground ; for no other will support the large and valuable breed. But he who has not this advantage, is not altogether to decline thus much of the grazing business ; only he should set about it in a different manner.

Let him buy in a number of young Welch heifers in August or September, and put them into the best of his ordinary pasturages. He is to take his chance whether they prove with calf or not, but either way they will answer.

If they prove with calf, he is to keep them till spring, and then he will sell them to a good advantage, with a calf by their side, for the dairy. If they do not prove with calf, they will presently begin to fatten upon his ground, which, though poor, is yet fine in comparison of what they have been used to ; and he will be able to sell them out at a good account at Christmas or in spring ; at both which times meat is dear, and consequently cattle fetch a price.

These heifers will, to the husbandman thus situated, answer the purposes of oxen ; and he is not to complain they do not bring altogether such a price ; because neither the cattle themselves, nor their keeping, have cost him so much.

The advantage will be the greater, in proportion as he has the convenience of hay, or turnips, which are the two foods for winter fattening of cattle ; and his nearness to some large city, where the demand and the price will answer to the expensive feeding of hay. About great towns they may let a beast eat two load of hay in a winter, because the demand is certain, and the price is good : but this will not do in remote places.

Let

Let him who buys cattle for fattening, take care in the choice, examining their bulk and shape, and the forwardness they are in at the time, and then proportion the pasture to the kind.

Those that are intended to be kept up for a winter, or early spring market, must be turn'd out in September into the rowens, and till the weather becomes severe, they will not need any fodder.

Upon the coming in of hard weather, they must have some hay every morning and evening. This must be proportioned to what the ground still affords. The more they find there the less they want of the supply; and the less there is, the more hay must be each time given them.

Frosts sweeten grass. The four grass, which the cattle had left untouch'd, becomes palatable to them after two or three nights of a large white ryme. They will eat this greedily; and it will make hay the less necessary, till the snow covers it, and they cannot get at it. At these times the foddering is to be largest, for otherwise they will, in a little time, lose all the advantage they had made in many weeks.

For those oxen that were bought in lean, and are not got into flesh by the beginning of the hard season, straw will do instead of hay: and he should begin with barley straw, and then come to oat straw, both which are good food, and will keep the cattle as they are, and in a readiness for farther improvement, when it comes on easy terms.

Toward the end of winter, the whole product of the ground will be eaten, and the oxen must be taken into the yard. If the husbandman have oxen in two conditions, the one that he feeds with hay, and the other with straw, they must be put up separate; and their food given in racks for them.

He often complains his cattle will not eat their fodder, when they are taken into the yard, though they did freely when it was given them in the field. This is generally owing to giving them too much at a time. An ox will eat heartily and freely out of the crib, till he has often breath'd upon it, and then what was left is disagreeable to him.

The inconvenience is easily prevented by giving a little at a time, and often.

Let the yard be well shelter'd, and kept dry. Let there be straw enough scattered about it, that the cattle may lie

sweet and warm, this will greatly assist in keeping them in good case. The expence is well employed, for what the straw is worth will be many times over made up in dung. Their trampling this, with their dung and urine, converts it into a rich manure; and the quantity becomes very considerable.

Oxen to be fattened on land, may be turned in alone or with horses; or they may be put into the pastures first, and the horses afterwards. But let the husbandman take care of the time of turning in his oxen. Many think they ought to let the grass be very well grown before these cattle are put to feed upon it; but they are mistaken. There is not a greater disadvantage, than the having his pastures too high grown before he put the beasts into them.

The ox does not love rank grass. In this case they only nip the tops, and the remainder rots upon the ground. When grass is grown too high in autumn it becomes four.

If it happen the farmer have in autumn, a pasture ground of tall grass; let him first turn in his oxen in a proper number, and they will eat off the tops; they should then be removed out of it. And horses should be turned in, who, not being so nice, will eat it down lower: after these he may feed it with sheep, which will still find a great deal, that the ox and the horse had left.

If the pastures be all of the same kind, and all of a proper grass for feeding of oxen, still let him frequently change their place, removing them from one close to another. This gives the cattle a variety of food; and it gives every piece rest to shoot afresh after their eating. Their taste will distinguish the growth where it appears to our eye all the same; and they will be pleased with removing from one ground to another. Each close will shoot up with freshness from their cropping, when it is quiet for a little time from the treading of their feet.

The husbandman should always purchase, as large a breed as his ground will maintain; and by this management he will find it support a better sort than it would in the hands of a less skilful person. The size of the ox is a great article, for it makes great addition both in the flesh and tallow.

Let the ox for fattening have a smooth forehead and a deep belly. The strength of his joints is needed when he is first designed for labour.

Preference

Preference is to be given to the young: but if they be somewhat older, let the farmer see that they are healthy. Let him feed up his own breed for slaughter, if he uses their labour till the best time of their working is over; but let him not buy them in for fattening at that age, without he bargain accordingly.

It is a good sign of health that an ox frequently licks himself. For when they grow sickly, they neglect themselves, and their coat becomes rough.

But every thing is to be understood within moderation. This, which is in general a sign of health, may be a disease. They will sometimes lick till they cannot eat, for they swallow a great many of the hairs, and these will get together into a ball in the stomach. In this case the owner must wash the ox with a decoction of wormwood. This taste it abhors, and finding it on the skin, will be cured of licking.

Some cover the creature with his own dung, but this is a filthy way. The ox will often tire himself, to get this off; or utterly neglect himself, which will prove of as bad consequence.

In examining how the ox proceeds in fattening, the sure way is to feel the hindermost rib. If all be soft and loose about that, 'tis a proof he is getting into flesh. The part behind the shoulders in an ox, and the navel of a cow, are the parts to be examined, to know the encrease in tallow.

One thing more is excellent toward the fattening of cattle, and this is the bleeding of them at times. It should be done once at least, or twice during their feeding.

The cattle I have bought in spring, I always bleed as soon as I put them to pasture, which makes them take to fattening directly. In those I buy in autumn I follow the same method, at the time of turning into good pasture; this not only helps their fattening but prevents disorders. This is all I do with those intended for the winter market; but for such as were bought lean to be kept for growing in winter, and fattened up in spring, I have them blooded when they are bought in, and again early in spring, when they are going into the pasture for fattening.

My neighbours allow my beasts are less liable to sicknesses than theirs; and I attribute it to nothing so much as these bleedings.

For those cattle which I buy lean in autumn, for the
D 4
spring

spring market, I always mix straw with the hay I give them. Barley straw does better for this than any other; and the quantity I allow is one third part. This answers for those beasts as well as hay alone, and in the affairs of husbandry every saving is to be regarded.

C H A P. XIII.

Of the cow.

WE have mentioned the cow in treating of the ox, as sometimes it is convenient to breed her in the place of that kind; we now come to consider her with her calf and milk.

Products from milk will be considered hereafter. We are here to treat of the creature herself.

The cow being chiefly intended for the dairy, care is to be taken in the purchasing a right kind, for there is a vast difference in the profit of this animal, according to the breed.

They have large cows in all those counties where they breed large oxen, but the size is not all that the husbandman is to consider; the quantity of milk is not always proportioned to the bigness of the beast; and that is to be his chief regard.

Welch and Scotch cows will do upon the poorest pastures: and they will suit some who cannot rise to the price of better kinds. They yield a good quantity of milk if rightly managed; but the fine kinds are the Dutch and Alderney: these are like one another in shape, and goodness, but the Alderney cow is preferable, because she is hardier.

The Dutch breed have long legs, short horns, and a full body. They are to be had in Kent and Sussex, and some other places where they are carefully kept up without mixture, and will yield two gallons at a milking: but in order to this they require great attendance, and good food.

The Alderney cow is like the Dutch in the shortness of her horns, but she is stronger built, and is not so tender. She requires rich feeding; but is not liable to so many accidents, and is equal to the other in the quantity and goodness of her milk.

Of which ever kind they be observe the following rules in their choice. Let them have the forehead broad and open;

open; the eyes large and full, and, except the Dutch and Alderney breeds, let the horns be large, clean, and fair.

They have, in some parts of Buckinghamshire, a kind that have no horns, they call these the polled breed. These are to be chosen by the breadth of the forehead; for their eyes are less full by nature, than those of many of the other kinds.

Of whatever breed the cow be let her neck be long and thin; her belly deep and large. Her thighs thick, her legs round and well-shaped, and her feet large. See that she have a large, good, white, and clean looking udder, with four well-grown teats.

Let the bull be of the same breed: and let them be of as large a kind as the pastures will support. But it is better, to have a cow of a smaller breed well fed than one of the best in the world starv'd.

The red cow it is said gives the best milk, and the black cow is best for her calf; but this is fancy. The red cows milk has been long famous; and a calf of a black cow is accounted good to a proverb; but the breed is the thing of consequence not the colour.

The cow that gives milk longest is the most profitable to the husbandman; and this is most the case with those which are neither very young, nor advanced into years.

The best time for them to calve is in the beginning of April, this is most favourable both for the calf and for the dairy.

The husbandman should know the time of his cows being to calve; and three weeks before that, to feed them better than usual. They should be put into a rich pasture, if there be a good growth of grass any where; if not they must be well fed with good hay. This will be returned many-fold in the profits of the milk.

When a cow has calved let her be kept the first day and night in the house, and let her water be a little warm'd. She is to be turn'd out the next day, in the heat of the sun; but should be taken in at nights for two or three days following, and some water a little warm'd given her before she is turn'd out in the morning.

In hard weather, cows that give a good deal of milk, should be fed in proportion: this should be with fine hay every morning and evening, when the ground is cover'd with snow; and at other times once a day, as there may be occasion.

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When a cow does not yield milk enough, to pay for a good feeding with hay, let the fodder be hay and straw mixed; or if still worse, let it be straw alone. But it must be oat straw, for barley straw dries up a cow's milk.

When there is a scarcity of hay, or the price is very high, let him give the cows in milk, malt dust, scalded with boiling water. When it has stood to be almost cold, it is to be given in the manner of a mash.

If the cow have this at times, she may be fed with any kind of straw; for this breeds milk so well, that the other food will not be able to dry it up.

About London they feed their cows with grains. This causes them to yield a vast deal of milk; but it gives it an ill taste; and is unhealthful for the cow. Malt dust is as cheap, and answers the same purpose, without danger of illness, or hurting the milk. A bushel will last a cow a week.

In February, when the pasturage is eaten bare, the cows are to be taken up and fed with dry meat according to their quantity of milk.

Milch cows should not be blooded unless there be pressing occasions, and in that case the quantity should be moderate.

The difference between one cow and another, in the quantity of milk, is so great, that there can no exact rule be laid down for their management when feeding becomes dear; only in proportion to the profit, should be allowed an expence in feeding. A cow may be kept in health, and flesh, for much less than she can be fed for the continuing to yield her quantity of milk.

The demand for the milk and for the cow, and the profit that may be at any time made by selling both, is to be consider'd; for the same thing is worth much more in one place, and at one time, than another.

In the neighbourhood of London there is so constant a demand, that the cow-keeper, partly with his early and late rank grass, partly with hay, and partly with turneps and grains, feeds his cows in such a manner, that they are at the same time in their highest perfection for milk, and fit for the butcher. But this is not to be done elsewhere.

But the difference between the milk of these cows, and those fed in the country, is very great. The grains make the milk poor.

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The price of grazing ground about Loudon is very great, but this is well answer'd in the present article, by that of the milk. This poor milk being sold at three-half-pence the quart, very bad measure, while in the country, but half a day's journey from London, 'tis a penny the Winchester quart; and in some places the milk quart is full three wine pints.

A cow in a good farming country, while in milk, is worth five pounds a year. This is reckoning her to yield about four hundred gallons in that time, which, with proper management, is a very fair computation.

If the whole quantity from a middling cow, be made into butter, there will be about two hundred weight a year; and there will be a value beside in the skim'd milk cheese, and in the whey, which serves for the feeding of hogs. From this we see the importance of this creature to the farmer, especially if he take care to keep her in tolerable flesh all the time, so that upon a short notice for fattening, she may be ready for the butcher.

There is another use to which the milch cow is put in some places, and which should be brought to account, that is, the suckling of calves. A good cow will suckle four calves besides her own, and grains will then be a considerable article in her food, for a great part of the year. Tho' the milk from grains be poor, there is always a great deal of it; and, though bad for the dairy, it is very fit for the breeding up of calves.

In Ireland they compute a cow yields for the first ninety days three gallons of milk a day; for ninety days more one gallon a day; for ninety more about a quart a day, and after this she is to be allowed about ninety days more dry.

This is the account of a poorer kind than ours, and in general a poorer pasture; but the price is less, and the rent of land less: so that all things consider'd, the profit may be equal.

No husbandman needs compute lower than this, the London account is the highest; and considering all things, the difference does not amount to so much, as might appear at first sight. The husbandman in general may reckon at a medium between them.

We have consider'd the cow as feeding upon pastures; but the custom is become general of raising what are called artificial grasses, saintfoin and the like, and is very beneficial.

Artificial grasses feed the beast finely, and occasion a great deal of milk, but they give it an ill flavour, which runs through all the things that are made of it, and reduces their price at market.

It is not adviseable to feed the milch cow upon these, when there is other food for her. The husbandman should never do it upon choice; but he may be led to do it by necessity. In this case let him use his cows only for the suckling of calves. A cow that suckles four calves, beside her own, in one year, will be worth five pound to the farmer: this is much the same with her common produce, any other way; and if she should be able to suckle five, the gain would be advanced five and twenty per cent. She is more likely to suckle five upon this feed, than any other; for it keeps her in heart, as well as causing abundance of milk: and in this case the ill taste is no disadvantage: the calves shew no aversion to it; nor is it tasted in the veal.

It is also adviseable to prefer suckling, when the farmer's pastures abound in such natural grass as gives a rankness to the milk. This is often the case, where the grass is large and rushy, as in marshy places. This food yields a great deal of milk, but with an ill flavour: the calves have no dislike to it, nor does it hurt their flesh either in taste or colour.

As to cheese, there are some grounds where it cannot be made to any good account. Where good cheese is not to be made, that work should be entirely let alone: in others the profits, considering every article, are about equal to those resulting from butter.

The dairy requires the nicest as well as the richest milk: therefore, where the circumstances will not allow of the cow's yielding this, her milk should be always put to other uses. Fine milk is the produce of sweet grass and good water. Where the food is rank, or the water bad, it will always have an ill taste; and for that reason, if the pasture be ever so good, and the water bad, it is best for to set aside all other thoughts, and use the cows for suckling of calves if practicable.

About London, where the cow is kept in flesh all the time of her milk, and is any day of ready sale to the butcher; as soon as she begins to fail in milk, the way is to sell her, and purchase a lean cow in the proper condition in her place,

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In the country something like this may be done ; but more care and time is required for it.

One of the greatest inconveniencies of sucking calves is, that they keep the cow down by the quantity of milk they draw, so that she is not ready to go to the bull again at a proper season. The farmer's business after this is to fatten her for the butcher.

In the beginning of May, or the middle of August, such cows should be turned into a pasture for fattening. This will take up four months, they will be then of ready sale ; and if these seasons are observ'd for turning them in to fatten, they will be fit for slaughter at a time when they bear a price. Those which are turn'd in at the first named season, are fit to kill in harvest time ; and the others a little after Christmas.

The price for which a fatted cow is sold at these seasons, will purchase a milch cow with a calf ; and pay for the time for her fattening. Thus the husbandman must contrive and compute : all things must be taken into his consideration. It is easy to get something by it ; but he who sets to work upon it with discretion, will double his advantage.

C H A P. XIV.

Of the calf.

WE have given the husbandman proper directions for the choice of his bull, and cow, and he is so far instructed toward the breeding of the calf. But a great deal remains to be said respecting its management : it may, in many cases, be made doubly valuable by proper care. Various methods are used in raising calves, according to the demand ; various means being employed to suit their flesh to the taste and eye in the markets. There are two ways of breeding those which the husbandman intends to rear. One is to let them run with the dam all the year ; and the other is, that of taking them away when they have sucked a fortnight.

In the cheap breeding counties, the first way is most usual ; and it is allowed to produce the fairest, stoutest and best cattle. It is done also with least trouble to the owner. These are inducements of consequence, but there are in many instances, others on the opposite side that outweigh them.

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When the calf is taken from its dam at a fortnight old, care is required in raising it: but in places where it is the common method, this becomes familiar and easy by use. They warm a quantity of flet milk, and teach them to drink it. This is most natural when of the same heat with the milk from the cow; and if it be much warmer, or much cooler, it is sure to do the calf harm.

The calf, in a little time gets some strength: it is to have milk given to it for a quarter of a year; and at the end of that time, water is to be put to the milk, and by degrees more and more till it be only water, and serve for drink, not for the sole nourishment.

Before it is brought to this, the calf must be taught to eat dry food. This is done by putting some fine hay in a cleft stick, and leaving it in his reach. It should be first put in his way when he is five weeks old; and he will soon take to it; so that by the time it is proper to wean him from milk, he will naturally feed on hay.

When the calves have got some strength, the husbandman is, in fair weather, in the middle of the day, to turn them out to grafs; they are to be taken in at night for a week, and some milk and water given them warm; and it is a good custom to set a little to them in a pail in the field: till they are able to feed and take care of themselves.

In the first turning calves out to grafs, care must be taken that it be a proper kind of pasture. It should have a short sweet grafs.

The best way of all is to wean the calves at grafs; for when they are weaned in the house, they become subject to disorders.

At three years old, such of the male calves as are intended for oxen, should be gelt.

In places where there is a quick demand, the best method is to fat all the calves for the butcher, except such as are necessary to keep up the stock. This demand is largest near great towns, where the price of the calf is high, and the grounds are not profitable to breed upon.

As the price of the calf depends upon the fatness and colour of the flesh, the care of the owner is to be turned to these two articles: in the which if he succeeds, his calf will fetch as large a price as a good heifer. The method is this. They keep them very clean, giving fresh litter every day, spreading the new upon the old; and
always

always keep a couple of large lumps of chalk hung up in their reach; and where they cannot fowl it.

The calf will lick these chalk stones, and their whiteness communicates itself to the flesh.

In building of the coops in which calves are to be fattened; the two great considerations are, the keeping them cool and dry. They build them in places where there is little sun; and raise them three foot from the ground, so that the urine naturally runs out.

When the calf is thus well fed, and carefully looked after, it is twice at least blooded: once of these times is at about five weeks old, and the other a little before it is killed.

When a calf purges, the custom is not to let it suck altogether, for the milk of the dam often throws it into this disorder, which certainly wastes its flesh. They give it milk with chalk scraped into it: which has a double effect; stopping the purging, and throwing more of the whitening matter into the flesh. They scrape the chalk very fine for this purpose, and after mixing it well with the milk, they pour it down the calf's throat with a horn.

When this will not remedy the disorder, and the calf is like to be spoiled, they use the cold bath for it; and give it some bole armenick, and chalk mix'd up with milk into balls.

If this does not answer, the generality know not what to do farther. But I have found that in the worst purgings to which these young creatures are subject, a small dose of diascordium made without honey, mixed with port wine and water made warm, and given with a horn, will do more good than all their remedies.

The calf must have no milk three quarters of an hour before, nor an hour after this drench, but it may lick as much chalk as it pleases. If this does not answer in the first dose, another may be given twelve hours after, and that rarely fails. The quantity each time is a dram. This never hurts the colour or taste of the flesh.

The calf may be disordered in the other extrem, and that is full as bad. If it be costive, the flesh of it will never be delicate. When this is observed, the method is to give a little manna; the best way is this: buy an ounce of ordinary manna, which they sell at a small price at the druggists; dissolve it in a quarter of a pint of water, and add

add a spoonful of brandy. Thicken up this liquor with fine wheat flower, and make it into crams, give the calf three or four of these every morning after he has been sucking, and dip them in milk to make them go down.

These medicines might have been reserved to a following part of this work, but as they concern the management of the calf for slaughter, I have set them down in this place.

The manner of bleeding calves is this. The first time it should be done in the neck, and not too much. The second is best done by cutting off a piece of the tail, and if this do not bleed so much as might be expected, it may be repeated at two or three days distance, by cutting off another piece, which will bleed just as the former.

One useful effect the chalk has, beside the whitening, is, preserving the veal: it keeps it dryer than it would otherwise be, and the wetness is what makes it soon taint.

The cow is subject to great irregularity in breeding of her young. Frequently there are parts of a second calf growing out of the first; and these monstrous productions are shewn about for their curiosity.

Nature often is so abundant, that the young come by twins; and we have instances of cows that have, for several years together, always brought forth two calves at a time, as if it were the natural condition of the animal. Dr. Plot, in his history of Staffordshire, tells us of a cow at Dunstall, that for three successive times brought forth two calves each, and a fourth time three: having no less than nine calves in three years.

The bull was doubtless the same to this cow, and to others; whence we may infer, that in the case of twins in our own species, as well as other animals, the cause is in the female more than the male.

The same author tells us of another cow that had successively three, two, two, and then three again, so bringing ten calves in the space of time as the other did nine: the cow which brings an abundant number of young at any one time commonly continues to do it.

Moreton says, that when the twins are one male, and the other female, the cow calf, if it be brought up, is always barren. In that, and in some of the adjoining counties, they shew a kind of cows which they call free martins, they have large horns like an ox, and they say they

they partake of both sexes. These are said to be the cow calves where they have been twins.

I have set down these articles, for the sake of farther enquiry. Writers are too apt to take things upon report, and we know how idle many of the stories are, which are confidently and universally propagated among farmers.

CHAP. XV.

Of sheep, and the several breeds in this country.

NEXT in value to the larger horned cattle comes the sheep; an article of vast concernment to the farmer: cheap in the purchase; easily fed; and returning a great profit several ways: even its dung upon the land often pays for all it eats while fed upon it.

We have advised the farmer in the choice of his larger cattle, to proportion their kind to the richness in his land: sheep are a stock for such as will not support the larger kinds. We see them thrive upon the most barren downs; and the farmer will find them fatten upon grounds which will not keep the other kinds alive.

As oxen are of different breeds, though all the same in kind, so it is with the sheep, which differ extremely according to the breeds in different places.

Great caution should be used in the stocking a farm with sheep: with respect to the breed, and in the choice of the creatures themselves; for there are, in every breed, many that are much finer than others, and these he should chuse. Half the profit that might be made by this part of the stock, is lost by carelessness in the first choice: but which is irrecoverable, except by beginning over again. We shall lay before the husbandman the properties of the different breeds of sheep in England, and advise him in his choice according to his main design, his best advantage, and the nature of the land he has to stock with them.

As to the fineness of the wool, there is a small breed, with black face and thin coat, that exceed all others. They bear but little, but the quality makes amends. These are easily known by sight. They were first raised in Herefordshire and Worcestershire; and are known by the name of the Herefordshire or the Worcestershire breed. A barren, and exposed pasturage will feed this kind, for they are hardy; and the shorter the grass, the finer the wool.

They are also excellent for the table. This kind is kept in parks and lawns, and they every where make a pretty appearance.

The kind most opposite to these are the large, tall, and heavy-loaded sheep: these have strong limbs, and a stout gait: they carry a great deal of wool, but it is coarse. These were first bred in Lincolnshire, and in the adjoining counties; and are fond of living in salt marshes. They have been taken into many parts of the kingdom, to other ground, where they do not keep to their nature; and yet are called the Lincolnshire breed.

The flesh is large grained, and no where very much esteemed. However, as they succeed in places toward the sea, it may be proper for the husbandman who has land in such a situation, to take some of them.

There is a breed between these two, which in general should be preferred to either. This is a large, tall, and strong sheep, of the best shape of any, and having the deepest coat of wool. This was originally fed in several of our midland counties, and has thence been called the midland breed; and by others, from some particular counties, the Leicestershire or Northamptonshire breed. The wool, tho' not so good as that of the small black faced sheep, is preferable to that of the Lincolnshire breed; and the quantity is so much greater than that of the small kind, that it makes amends for the inferior quality.

The flesh of this is the common mutton, not in any thing particular for goodness or badness. It will do very well upon the common pasture ground. These sheep should be therefore most generally bred.

When the husbandman has very poor pasture grounds, let him take the Herefordshire breed; and when he borders upon the sea-coast, or upon the shores of large salt water rivers, the Lincolnshire kind: but when he has none of these reasons let him prefer this midland breed.

Sheep bred in the northern parts of this kingdom, are large and big boned. They approach to the Lincolnshire kind in shape; but their wool is harsh, rough, and hairy, these are called by some the Yorkshire breed.

Their flesh is inferior to that of the other kinds, as well as their wool; but they have an advantage, in that they will stand the coldest weather, and take care of themselves where others would be lost. This may recommend them to the husbandman whose lot has thrown him far north, where

where the other kinds will not thrive; but he should not introduce them into his farm in any other situation, for they are less profitable than the rest.

The last breed to be mentioned, is peculiar to mountainous countries; and most frequent in Wales. It may be called the Welch breed. It is a small, but well shaped sheep; and so hardy that it will live any where. The flesh is excellent for the table: but the wool is small in quantity, and the worst produced by any sheep of this country.

The husbandman will see it never can be his interest to admit this breed among his stock, unless compelled to it by the particularity of his situation. The little black faced sheep of Herefordshire has the same advantage in the excellence of its flesh; and it has the finest wool in the world. Therefore it is highly to be preferred, where it will thrive: and it will do on very poor and very exposed ground. However, if the farmer finds his pastures so poor, so exposed, and miserable, that they will not support this kind, all he has to do is to call in the Welch, which will live any where.

CHAP. XVI.

Of the choice of sheep.

HAVING given this account of the principal breeds of sheep, our next care must be, the instructing the farmer in his choice, not only of the breed he shall fix upon, for the grounds of that have been laid down already; but of the particular creatures he shall fix upon in the breed most suited to his purpose.

He sees five kinds of sheep, some large, others smaller; and some yielding a greater, some a smaller quantity of wool; which is on one breed fine, and on another coarser. He has his choice among all these, for we suppose him not yet to have begun stocking his farm: it would be natural to prefer the finest kinds as most profitable; but every breed will not suit every pasture.

He has seen the kinds of sheep: let him examine the nature of his land; and then fix upon that which will thrive best on such pasturage he has at his command.

He will have more profit from the worst kind that shall thrive upon his land, than he can from the best that shall starve upon it.

Let him observe also the difference of the land to which he is to bring them, from that whence he purchased them:

this must be in favour of the land to which they are brought; for any breed will decline upon coming from a richer pasturage to a poor one.

Let the farmer see that he buy a kind suited to his grounds; from a worse land than his own, for upon that will depend their immediate thriving.

Having settled the general points, let him proceed in the choice of each particular sheep.

Whatever breed they are of, let them be stout, hearty, well made, and big boned; let him see the wool be soft to the touch, and fatty in the handling; and that it be clean and well curled.

Sheep of this condition, in whatever breed, bear the largest quantity of wool: and these are marks that make them bring a price at market. The butcher has his rules for judging as well as the farmer, and these are the things after which he principally enquires.

The choice of sheep to breed is a material article. Let the ram be young, handsome, and well shaped, his wool clean and grow well; and the skin underneath of the same colour. Let his body be large and long; his forehead broad, round and rising; his eyes be large and of a cheerful aspect, and his nostrils strait and short.

Sheep without horns, called the polled breed, are the best breeders.

Chuse the ewe for breed thus; let her neck be large, but naturally bending like the neck of a horse. Her back should be broad, and her buttocks round: her tail should be thick, her legs small and short; and her wool thick and deep.

To know if they be sound, let him examine whether any of the wool be wanting: let him see that the gums be red, and the teeth white, the felt loose, but the wool firm, the breath sweet, and the feet not hot.

Two years old is the best time to buy them at. They will bear good lambs till they are seven. Their age is to be known by their mouth. When they are one shear they have two broad teeth before; when two shear, they have four, when three shear, they have six; and when four they have eight: after this their mouth generally begins to break.

Nothing shews a bad condition more than the dullness of their eyes, and the looseness of their wool. If these marks be upon them, they will never stand.

C H A P. XVII.

Of the breeding of sheep.

THE rams and the ewes being chosen for breeding, the husbandman is to consider the best time for putting them together. More care is here recommended, than usually is taken; but not more than is proper or requisite. The husbandman by industry and knowledge, may obtain much larger profits than the common run of persons in this business are content with: although less care may do, he who uses the most will have the largest gains. The farmer in every article of his business, should consider the event before he fixes upon the means; and always have the end in his eye when he is about to make a beginning.

Before he puts his rams and his ewes together for breeding, let him compute the time of their going with young, and when his lambs will be brought forth. Let him then see what season will be best. Let him consider at what time in spring his grass will be fit to maintain the ewes and lambs; and put the rams and their females together so long before, that will bring the young at that time.

Let him consider whether if they fall early he shall have turneps to support them till the grass comes; many a time the husbandman, for want of timely care, has lost both his ewes and lambs for want of food.

The considerate farmer is to take care he is sure of a support for the young and their dams when required; and that it be a sufficient and good food for them. That which will keep them alive, will not always be sufficient for their thriving. If there be a defect in either quantity or quality, the lambs will be stunted at first, and this they difficultly recover.

The ewe goes with lamb twenty weeks, and the best season for them to yearn is, toward the middle of April; except where there is very forward grass or turneps. If on any occasion, it is necessary to have them yearn much earlier, they may be put together accordingly.

In this case there will require a great deal of care for the lambs for some time. They are very tender when first brought forth, and if they are not tended, magpies will peck their eyes out: and the coldness of the season keeps such as fall in January or February tender and weak longer

than those which are brought forth at a more advanced time: and therefore a nicer care is required to breed them up; and it must be continued a longer time.

The best land to breed sheep upon, when the farmer has variety, is to be judged by these qualities. A rich pasture breeds well shaped and tall sheep, according to their kinds; such as have short grafs breed lower but well set sheep. Those which are bred in mountainous or woody places, are commonly small limb'd and low.

Dry pastures are the fittest for this purpose: wet grounds, and such as are liable to be overflow'd, being hurtful; excepting only the salt marshes, which, for the proper kinds, succeed very well.

These rules are subordinate to those more general ones, which have been delivered already. The breed of his sheep is the great article in respect of their size, and he has been informed before what breeds suit what lands.

The farmer who is about breeding of lambs, should save the grafs and weeds that grow in the lands he designs to fallow in winter; and turn his ewes and lambs into them in March.

When sheep are turned into wheat or rye to feed, he must take care it be not too rank, for in that case it gives them purgings.

No cattle should be fatted while they are going with young: they should be kept then upon a moderate pasture, except the three last weeks. This is to be more carefully observed with sheep than any other kind. If they be fed too high the whole time, it will go hard with them in yeaning; but if they are not put a little into heart before they come to it, they will want milk.

The best time of yeaning a lamb is at four months: but in general there need no caution to be used at all. Nature does this, and the owner knows nothing of it.

When the farmer has plenty of good grafs, and his rams always run with the ewes, he need not give himself any trouble about the weaning of the lambs. The ewe will go to ram of her own accord; she will then become dry, and the lamb will be weaned naturally.

In pastures which are subject to give sheep the rot, it is best to let the lambs run by the ewes longer: these tender creatures are more ready to come to harm than the full-grown ones in those unsound places; and sucking is the best preservative against it.

If

If the farmer have suspicious pastures, and finds his lambs want milk, it is best to sell them: for it is not the running by the ewe that will preserve them, she can be of no service, if she wants milk.

Those that are intended to be bred as rams, should be separated from the rest, and the other gelt in time. Every creature bears this best while it is with the dam.

C H A P. XVIII.

Of the shearing of sheep.

THERE are two articles in the condition of wool which enhance its price. These are fattening and cleanness: and it is in the owner's power to give it these in a much greater degree, by his care. The first will be increased by the time of shearing the sheep, the other by cleanness.

Fattyness of the wool never gives it any value unless it be also clean; and the cleanness will discover its imperfection, if it be not fatty.

The fattyness is owing to the creatures sweating: therefore there must be some hot weather past before it is sheared: it must have sweated many days together, that the moisture may have lodged itself about the wool, and in a manner oiled it so, that the washing for cleanness shall not carry it off.

Unless the sheep have sweated well before washing, that will do as much harm as good: for as much as it increases the price by cleanness, it diminishes it by taking off the fatness. It is necessary sheep should be well washed before they are sheared: but unless they have well sweat in their wool first, this will hurt it.

Upon this foundation depends the art of sheep-shearing. The best season is toward midsummer. But let the weather determine, and let not the farmer be carried away by the name of any day, or month, against the use of his reason.

June is commonly the month; because at this time of the year there commonly has been some hot weather: and there follows hot weather after it. But if any year the season prove very cold in the first part of the summer, let him defer it till July; and, if very hot weather come in early, let him go to shearing in May.

If the end of May be hot, he is to begin early in June;

and if the hot weather have not come in till the beginning or middle of June, he is not to shear his sheep till the latter end of that month. We would not have our farmer oppose the common methods, unless where they are wrong; but understanding their foundation, he will often find it convenient to depart a little from them.

When he has on these principles settled the time of shearing for that year: the next care is to prepare for it by settling the time of washing the sheep, and giving them opportunity to dry themselves clean.

A good place of washing is to be fixed upon, and a piece of clean and dry ground in which they are to run till they be dried. This, and the washing place, should be as near as may be.

Though it is needful that the sheep be washed before it be shorn; it must not be shorn while wet: and if suffered to run at random afterwards, and get dirt, the washing would not be of much effect.

The whole being thus understood, and all things ready, let the farmer proceed to the washing of his sheep. Let him see this be done thoroughly and carefully. There is a way of slighting business in such a manner, that it might as well have been let alone; and this is too common in washing of sheep, which is a thing very troublesome to do well. If the farmer does not see it done well, he will not be able easily to know afterwards, whether it be well or no.

The presence of a master is always useful; but in no article more than this.

When every sheep has been thoroughly washed, let them be all turned together into the ground designed for them, and there be left to run till they are dry. This will take two, three, or four days, rarely more, for the season is seldom very unfavourable at that time of the year.

After this let the shearer get to work, let him be one who understands his business: for an ignorant or careless fellow at this work, may do his master more damage in one day, than a month's extraordinary wages would cost him.

Let him over-see every thing with his own eye; and if he perceive any sheep half washed when it comes to the hands of the shearer, let him send it to be washed again.

Let him see the shearer be careful not to hurt the sheep, cut them, or prick them with the point of his shears: the
flies

flies will take advantage of these wounds, and torment the naked creatures to madness. Finally, let him see the wool be carefully taken off, and well wound up.

It is a good custom to shear lambs with the sheep. But he need not be very strict and exact about it all over. The principal care is to shear them well behind.

Before they come to be shorn it is necessary to cut away the wool of their tails, and just behind, that the dung may not hang on it: this makes the creature sore, and brings the flies. When they come to be shorn they should be cut close behind; but very little before.

Sheep damage their wool by lying in dirty places, for they are not naturally a cleanly animal. For this reason the wool of the same breed of sheep, is much finer in those counties where they house them at night, than in other places. In Gloucestershire, they house the sheep at nights, and litter them with clean straw. The expence is very well paid by their dung, which, together with their urine mixing among the litter, enriched also by their sweat, and the fatness of the wool, makes a fine, rich, and precious manure.

The method of throwing in sandy or other earths, to be enriched by the dung and urine of the animal, is better than this of straw, when the article of manure only is considered; but taking the wool into consideration, this by straw is preferable.

From these methods, practised in different places, the judicious husbandman increases his knowledge; and his profits in proportion.

He will now be able to determine upon a conduct in the management of his sheep, which although built upon the practice of different counties, in separate articles, is preferable, upon the whole, to any one of their methods singly.

If he use the covered fold, for the sake of raising a quantity of manure with sand and other ingredients, during the rest of the year, he will do well to throw in clean straw, by way of litter, for the four or five weeks before the shearing. This will give him a considerable advantage as manure, though not equal to what he gets the other way, and what he loses in that respect, he will gain by the fineness of the wool.

Upon this principle the husbandman may reasonably have a kind of covered fold, ever so slight, on the ground where

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he turns in his sheep, between the time of washing and shearing. Let him strew this with clean straw, by way of litter; and see the sheep all driven into it at night. This they will very readily do, because they will feel cold after their washing; and by this means, lying clean and dry, they will keep the wool very nice for the shearing. There is also a cleanliness in the nature of straw that will be a great advantage, for they will rub themselves upon it to a clean bright hue in the wool, which it will not have any other way.

C H A P. XIX.

Of the breeding up house lambs.

THE price of house lamb, at early seasons, is so considerable, that it may be well worth while for the husbandman who is situated near large towns, to raise some for this purpose.

To this end three things are to be considered. First, to have a proper kind of sheep; secondly, to put the rams and ewes together at a right season, and lastly, to provide proper pens in an house for receiving and nursing up the young.

There is a sheep of the midland kind, but a little smaller, remarkable for naturally lambing very early. If left to themselves they will bring forth about the middle of December; and, if properly put together by the husbandman, they will come somewhat earlier. These lambs brought forth in the dead of winter, may be reared at home, and will bring a price that will answer the trouble.

This kind of sheep is bred principally in Hampshire and Wiltshire; and is known among the common people by the name of the wey-hill sheep.

The husbandman who finds from his situation, that he may have a demand for house lamb; and that he has conveniences for raising it, should take his opportunity to buy some of these wey-hill sheep at the best market; chusing the rams and ewes, according to the direction laid down here for that purpose. Let him not leave their time of breeding to chance, but keep them separate till a proper season, and then put them together.

The ewes are to be fed in a pasture not too rich, for the greatest part of their time; and three weeks before their lambing, they are to be brought into a richer: and as the time of their bringing forth is known, let care be taken of them,

them, and of the lambs as they fall, that they be not hurt by the severity of the season.

The last care is the bringing them up for the purchase of the butcher.

Many arts are used; and different directions have been given about it, but the whole may be delivered in a few words: the husbandman, upon the principles of good sense alone, will find most of those cautions might have been spared.

The whole care consists in two articles, the keeping the lambs warm, and the feeding the sheep in such a manner, that they may supply them with a rich milk. Let him look to the lambs with due care, to see they are warm and clean; and feed their dams as he ought to do, and he cannot fail.

The severity of the weather would destroy the lambs, if they were left to ramble about with the ewes; and the scarcity of food, would make them unable to fatten them by their milk; but good food will make rich milk, and a due portion will yield it in due quantity.

Sometime before the ewes are expected to bring forth, let pens be built for them, in an house that is warm, but not shut up close.

As soon as the lambs are brought forth let them be put into these pens, and from that time watch'd and tended, that they may be always warm, dry, and clean.

The milk of the ewes now they have lamb'd, is to be enlarged and enriched, by giving still better food.

The best is turneps; but where they are not in readiness, the ewe, beside her rich pasture, must have, at times hay, bran, and oats given her.

These supplies do not enrich the milk in the manner of turneps; therefore he should not fail to have them for the occasion.

The ewes are to be brought into the house three or four times a day, to suckle the lambs; and, as those young creatures are kept very clean and comfortably, and feed to their fill upon rich milk, and upon nothing else; they will fatten quickly, and their flesh will naturally be exceedingly white and delicate.

The ewes thus fed, have plenty of rich milk, and the lambs sucking to their fill, and being kept quiet, fatten upon it freely. As to the difference of season they feel nothing of it; for so they be kept warm, it matters not whether

whether it come from the sun, or from their comfortable shelter.

The advantage land receives from the folding of sheep is very obvious; but let the husbandman take care he does not lose more by the damage he does his sheep, than he gets by enriching so much of his land.

Nothing tends more to give sheep the rot, than folding them, when due care is not taken.

Sheep are to be put into these folds at night, in summer, but let him take care only to do it in good weather. Let him see they are not turned out in the morning, till the sun has been some time up; and let him take care they are driven to a good feeding place; for otherwise, being hungry, they eat any thing; and thus, between cold nights and bad food, they often get the rot and perish.

CHAP. XX.

Of hogs, their advantages and evils.

A GREAT recommendation of any animal, is the cheapness of its food, and this sets the hog above almost any other: little is to be bought for that creature, and he consumes very little of the stock, any thing contenting him that is eatable, though his appetite is greater than that of any of the kinds yet mentioned.

If food is to be raised purposely for the hog, it comes very easy; coleworts, and any other of the coarser vegetables answer for this use: they grow any where, and are sown with little trouble; and the worst of them will fatten the hog; in which condition he supplies the family and the market, to a very good account.

The flesh serves in a variety of forms, and when the more marketable parts are disposed of, there remains a great deal for the family.

The refuse of every thing serves them for food, whatever is thrown from the barn, the kitchen, or the dairy. If they be suffered to run free about, they will, in a great measure provide for themselves; but this is not a profitable method. Our husbandman doubtless is acquainted with that good old observation, that all that is saved is not got: while they get food for nothing, they waste their flesh by running about; and what is lost in their value, is much more than is gained by the saving.

Having named the good qualities of the hog, it is proper

per to mention the bad: the farmer should know the advantages and disadvantages attending every kind, that he may purchase accordingly. Hogs are the most ravenous of all the creatures kept about houses. They spoil and destroy more than they eat, if they are not kept with proper care; and their rooting up the ground is a troublesome and mischievous quality. No creature is more apt to break fences; and the mischief he would do if left at large would be endless.

These ill qualities, are to be guarded against; and in proportion as the farmer is in danger of being more hurt by them, and has it less in his power to prevent them by a proper manner of keeping, the more cautious ought he to be in the buying any large number.

The way is to prevent these accidents, by keeping the hog up. In running at large he wastes his flesh; keeping them penn'd up is beneficial, not only with respect to their flesh, and its profits, but to the dung; for whatever is thrown to them, that they do not eat, they trample to pieces, and being mixed with their dung and urine, it becomes manure.

In places where it is not convenient to keep them enclosed, their rooting up the ground is to be prevented by putting rings into their noses, and their breaking fences by their being yoked.

These are the remedies for the evils, and the husbandman who has already seen their good and ill qualities, will judge according to the circumstances of his farm, whether it be convenient for him to engage in the feeding many of them or not.

CHAP. XXI.

Of the several breeds or kinds of hogs.

IF any one determines to keep swine in large numbers, let him be careful in chusing his kind. There are not so many breeds in swine as in sheep and oxen, but there is a great deal of difference.

The principal breeds are three, 1. The wild hog, which is small, but hardy: it will feed upon less than any other, and its meat, though less in quantity, is preferable to that of any other. 2. The common hog which is larger, longer legg'd, and bigger boned than the wild, and affords an excellent bacon: and, 3. The low big bellyed hog, which

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is of late become very common in most parts of England. This lives cheap, is less mischievous than the others, and breeds very fast. But it is inferior to the common swine in its advantages to the farmer, all things being considered.

The low hog is to be chose by those who live in and about large towns, to run about the streets, where it takes care of itself, and does better, being of a quieter disposition than the others: the farmer in the country is to chuse the common hog; being the largest in its growth, bringing forth a sufficient number at a litter, and being easily fatted for the service of his family, or for market.

In some counties these creatures thrive better than in others, particularly in Hampshire, Leicestershire and Warwickshire. It will be prudent, if it can be done with convenience, to buy hogs for breed from these places; and let the purchaser be particular in their shape.

Let them be chosen with long and large bodies, deep sides and bellies, and very thick thighs; let the neck be thick, the nose short, and the chine full and well set with large and strong bristles.

When the farmer has a proper kind of hog for stocking his yard, let him be careful in suiting the number to the extent, and to the quantity of the provision he will be able to supply them. He must take care, that he do not take in too many; for no creature breeds faster, and if he does not use moderation, he will be over-run with them.

The great increase depends partly upon the number the sow brings forth at a litter, and partly from the shortness of the time she goes with young. One of these creatures will have four litters in a year, and they will bring from eight to twenty at a time.

When a sow brings more than she can raise, they must be put to other sows, if there be any in the yard in a proper condition to suckle them; if not, they must be destroyed, for there is no other way of rearing them.

The more hogs there are in a yard, the more ravenous they are, for they grow greedy by observing the eating of one another: and if there be not sufficient food at the time when they give suck, they will eat up one anothers young, or even their own: so that great care is to be taken, that more are not received in than can be fed.

Let the farmer chuse the largest and stoutest of his pigs for the continuing the breed: one rule of judging early of
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their qualities, is observing which suck the foremost teats: they all aim at this, and the strongest get them.

After the proper number of the best and strongest pigs are chosen out to be reared for breeding, such as are not disposed of while pigs for the spit, are to be gelt or spayed according to their sex. This increases their fat.

Great quantities of hogs are raised by the brewers, and malt distillers, because of the convenience of their grains; but of this more need not be said here, the method being known and easy, and now delivered among the rudiments of those professions to such as learn them. They are kept clean and well fed, and nothing more is required to their thriving.

There are two ways of managing the flesh of the hog for service; the one for pork, and the other for bacon. According to the choice of these, the age of the creatures is to be different. Nine months old is the proper age of the hog for killing for pork, and the finest time for bacon is when they are a year and half.

The stoutest and best pigs are had from sows of three, four, or five years old, but they will begin to breed at one year, and continue till they are seven; the three years I have named are the prime. The boar should not be less than two years old, nor more than five.

He is no loss at the end of this time, he may be sold for brawn, if an opportunity offers; if not, he may be gelt, and will fatten very well: nor does the operation, though performed so late, do him any harm.

Prudence is required in the managing this creature. An error any way in respect to their food, is very prejudicial: for the general course of their lives it matters not much what it is, but due care must be had about the quantity. If they are allowed too little, they will be ravenous and mischievous, and if they are fed too plentifully, they will not be healthful. They should be kept in heart and strength by moderate feeding, till the time they are to be fattened up for killing; and on this article depends a great part of the profit that shall arise to the owner.

C H A P. XXII.

Of the feeding of hogs.

THE best method of feeding hogs is to keep them for the most part in the yard: their food should be wash every

every morning and evening: dish-water with grounds of drink, and a few grains or other offal: for the rest of the day they may be suffered to graze, in damp sedgy grounds, and the refuse of the garden is to be thrown to them in the yard.

Hogs feed excellently in woods, and under hedges in autumn, when the wild fruits are ripe and falling: they eat every kind; hips, haws, sloes, acorns and beechmast, and these are a natural and excellent food. If hogs could be fed thus constantly, their flesh would be sweeter and better tasted than it is in the common way of fattening; but in some places there is little of this food: it falls out only at one season of the year; and the creature is not well to be trusted. When all things concur, the flesh of a hog thus fed is excellent: some think this food alone will not give firmness to the fat, but experience shews they are mistaken.

When hogs are to be fatted in the sty, cleanliness is a great article. They must also be fed often, and not too much at a time: their ravenous appetites will always lead them to eat more than they can digest. Their food must be fresh and good; they must have as much fresh and sweet water as they chuse to drink; and they must be kept quiet. In this manner they will fatten soon and well. Their fat will be firm, and their flesh well tasted.

Nothing answers so well in all respects for the fattening of hogs as the fruit of the wild trees; they have air and exercise while they get it; and they live clean. These are great reasons, but where there is not a convenience of getting this food, or the season of the year does not suit, the way is to fatten them up altogether in styes, and this is to be done with pease: when they happen to be dear, the meal of offal corn will answer the purpose: these are to be mixed up with whey or skim milk, or milk and water, and the creature will never fail to fatten upon any of them.

It will take about a month to fatten a hog in this way, supposing him to have been in that midling condition before, which we have recommended for the sake of his health. Pease are prefer'd to the other foods; and there is such an opinion of their effect in giving firmness, and a clean taste to the fat of the bacon; that when they happen to be dear, although the hog be fatted up with the other things, they generally give him a good quantity of this food the last week.

Hogs

Hogs eat the buds of many trees, particularly the ash and sycamore, and it is a practice in some places to beat down sycamore leaves for their food, upon which they will fatten.

Grains fatten them quickly; and often when they will not thrive with any other food, these will bring them to themselves, and they will afterwards fatten upon any thing.

The way hogs are fatted in some places, for the navy, is excellent; and where there are conveniencies for it, should be followed by all who deal in these creatures. They take in a piece of ground by the side of a running water, hedging in part of the water that there may be a place for the hogs to drink without danger of their escape. They stack up a quantity of beans and pease in this inclosed piece of ground, and turn in as many hogs as the quantity of food will fatten. They let them live at ease and liberty one among another, cutting down the stacks as they are wanted. Thus having plenty of food and water, and room and quiet, they fatten excellently.

As the hog is often apt to waste its food if too much be given at a time, they have a contrivance in some parts of Oxfordshire to prevent this, and at the same time to save the trouble of that constant attendance, which is required in feeding them with small quantities at a time. They place over the sty a vessel like the hopper of a mill, and into this put as much beans, pease, or other dry food as will fatten such a number of hogs. From this there comes a large square pipe down half way of the sty, through which the food continually descends out of the hopper. This pipe terminates at that distance in six smaller pipes, each of which ends in a little trough, no bigger than just to admit the nose of the hog; and they come all of them with their ends so near the bottom, that there is never above a handful of the food at a time in each trough. When this is taken away by the eating of the hog, there follows so much more. This prevents their wasting the meat, at the same time that they have a constant supply: and if it happen from the convenience of the place, that a small current of water can be brought through the sty, they will in this manner be fatted with less trouble, than in the way already mentioned of stacking the beans and pease for their service.

The inconvenience from hogs rooting up the ground, has been mentioned; and the common method of preventing it, by a ring in their nose; but as this is often ineffectual,

and a great deal of mischief may be done unexpectedly by these creatures, we shall propose, to the imitation of the farmer, a method much more secure, which has been long practised in Staffordshire.

Instead of the ring they use a forked iron, armed at each point with a fin like the half of an arrow head. This being thrust through the edge of the hog's nose cannot be got back; and they cap the bottom or square part of the fork that lies upon the nose with a long and hollow ring, which turns round upon it. So that the creature can never take hold enough to turn up the earth. This is very easy, and it shews its own use. The damage hogs do by rooting up the ground is sufficiently known; and many have found how unfit the common method by rings is to prevent it.

The method of feeding hogs on clover, has been mentioned in another place, when we were speaking of the dung as a manure; and something farther may be properly added here. Clover is an excellent food for the hog, but it is best not to make it the only kind, for it is apt to give a yellowness to the flesh, which hurts it in the market. The best method of giving hogs clover is, at the same time that they are feeding at other hours on different things. Let them be turned out of the sty without their breakfast of wash in the morning, that they may have a good stomach for the clover; and at the right season let them be driven into the field with the horned cattle. At evening let them be brought home, and fed with wash mixed with grains or corn, or let them have instead of the wash, a great deal of skim milk or whey.

Bran and pollard fatten hogs speedily, but the flesh is not firm; nothing for this purpose answers like the pea or bean; a great variety of food might be mentioned for a creature that will eat any thing, but there are none of them come up to these, which are natural to the animal.

The distillers wash and grains feed them up quickly, but there is a great difference between the bacon and pork fattened by that means, and such as are fed on the natural fruits of trees or pulse.

The same kind of food is also excellent, given properly, and in due quantity for the feeding of pigs: at their first weaning, the best food is skim milk, whey, and the artificial grasses. After a week or ten days, it will be proper to add bran or grains to the whey or milk; and soon after this they may have pease and beans in moderation, and this will

will encrease their growth, and make their flesh better. After this, if they have been pig'd in an early season, they will come in for a share of the stubbling and beechmast which will raise them beyond expectation.

A great advantage in this respect is owing to the season of their being pig'd; the spring, or early in summer, is the best time for those intended to be brought up; such as are farrowed near winter, if ever so much care be taken of them, grow slowly, they are often stunted; and they are always more subject to diseases than those which come at a more favourable time.

C H A P. XXIII.

Of goats.

THE goat is not to be set upon an equality with the sheep or swine, but there is an advantage attending it which none of the others have: this is, that it will live where neither ox, sheep, or even hogs can. The goat should be bred in all such places, for the profit is something; and it is the only kind that can be had.

The goat will feed in common pastures, but there it is not worth while to breed them; for sheep of one kind or other will live there; and the worst kind are greatly preferable to the goat in profit. The goat is apt to crop young shoots of trees and shrubs, and in this respect may easily do more mischief than he was worth.

These are sufficient reasons against breeding this creature in common grounds, but where there is hilly, barren and useless land, 'tis every one's interest to raise the goat; for it will walk at ease where any other animal would break its neck, and feed where other kinds would starve.

The natural soil and situation is a barren, rocky, and craggy mountain. These places produce briars, and other small shrubs, and upon the shoots of these goats browse with the greatest satisfaction.

In general the food of goats is such, as is of no use to any other creature; and they are to be bred with little care or trouble. For these reasons I would advise every husbandman who has barren, bushy, and rocky high ground, to keep them; and that he may make the greatest profit from them, I shall lay down some observations which I have received from a worthy correspondent upon the borders of Wales.

There is less difference in goats than among most other kinds; yet for the farmer who intends to bring them to a new place, the following consideration should be observ'd.

The best goats are those which are strongest limbed, and largest bodied: let them be chosen for breed, big made in every part, and covered with a deep stiff hair. Let their joints be firm and strait, the neck short and thick, and the head small and slender, with full and large eyes, and long stout horns. The colour is not material, but in general the black goat is the stoutest, and a long beard is a sign of a good kind. Pyed goats are supposed to bring forth the finest and best tasted kids, but this is not certain.

Goats being thus chosen, the next care is putting them together for breed. No creature is so ready for copulating. The best season is toward the middle of winter. The he goat should be from two to five years old: he is best if about three or four; and the she four, five or six. The he goat wears himself out by his frequent copulation, and is enfeebled by age at six years old; after which time his young are poor.

The she goat is troubled with few distempers, and is a free breeder; they will bring forth twice a year, and they have sometimes two, and sometimes three kids at once.

The goats should be kept in herds or small flocks; and though they are hardy, it will be a great advantage to them if they have shade in summer, and shelter in winter: But this last must not be carried too far: if they be housed in the hardest time, they should have no litter for that will make them too hot: they are used to hardship in their natural way of living, and nothing is so likely to do them mischief as too much tenderness. Cleanliness is a great article when they are housed, for as they are used to sweet air, and are in themselves very rank; if they are kept hot and frowzy, they fall into disorders.

Nothing will require a stricter care, than defending trees from them.

It is enough for the defence against other animals, to train them up so that the branches shall be above their reach from the ground, but the goat will climb old trees, particularly the elm, of whose young shoots it is fond, and will browse for days together among the young branches.

For this reason as barren and rocky grounds, are fit places for them, they should be confined to these alone. Otherwise they will soon do more mischief than they are worth.

Keeping them in bounds, is not difficult; and there are a great many places in England, where a considerable profit might be made by breeding them.

The advantages from the goat are four. The milk, the flesh of the kid, the skin, and the hair: the two latter are less regarded.

The hair is used for twisting into ropes, and will never rot in water. In some places it is wrought into a kind of cloth for apparel.

The skin is dressed into a very good kind of leather, in some places, though altogether neglected in others. Goats milk is of the nature of asses, restorative in consumptions, and for decayed constitutions; and in some counties they make good cheese from it: in other places, where the stock consists partly of goats, and partly of cows, they mix goats milk and cows together, and this way it yields a very good kind of cheese, according to the common way of making. This is the practice I should advise to the farmer who keeps goats. There is scarce any place where he may not upon the better pieces of his ground, keep some cows, and the goat's milk answers much better, and is managed much more easily for cheese in this mixture, than alone.

The flesh of the goat is rank, and unwholesome, but kid is a fine meat, little inferior to venison; and as the kid is easily had, and rear'd with little trouble, were there no other reason for keeping of goats, this were sufficient. People that are delicate about the flesh, rear kids for the table, as we have directed for lambs; but, with the least care imaginable they grow to an excellent condition, as they run wild after the dam.

C H A P. XXIV.

Of the rabbit in general.

THE rabbit is very well worth regarding, as a part of the farmers stock. It will thrive where nothing else can live; and has a great encrease by young.

Both the buck and doe rabbit are eager for copulation, and they must not be restrained. The does go but a month with young; and as soon as they have brought forth, they are ready to copulate again. When they run wild they get together in a very little time; and when they are kept tame and separate, they must be put together soon after the bring-

ing forth, otherwise the doe grows sullen, and will take little or no care of her young ones.

The rabbit is of two kinds, wild and tame. The wild runs loose, and burrows holes in the ground, and the tame is kept in houses, huts, or boxes.

Both kinds yield a large profit, though under different management. The wild rabbit breeds fast and freely in warrens, where there is room and a free air. They will thrive upon the poorest and barrenest soils; in these grounds the farmer will find advantage from the breeding of rabbits, either altogether or occasionally; in the latter way they improve these barren lands extremely, by their dung and urine, and render the worst of them fit for raising crops of rye; and such as are but a little better, for the other kinds of corn.

The distinction between wild and tame rabbits is not founded in nature, but on our own practice; for the wild kind may be as well kept tame as the others. They are used to a kind of imprisonment in their holes, and for that reason they bear confinement better than other creatures.

C H A P. XXV.

Of the wild rabbit.

THERE is properly but one breed of the wild kind; and all the direction needful in its choice is, that such as are taken to begin a stock, be large and big bodied, with a good deep fur that hangs fast upon their backs, and with stout limbs. The husbandman that has waste ground fenced well, and not with live hedges, should never omit this part of his stock.

A small number is sufficient to be first turned in, for of all creatures useful to mankind, they are the greatest breeders.

The wild rabbit succeeds better in some places than others; the young growing up much quicker, and the flesh being finer: the reason of this is to be searched in the soil and produce; and this may teach the husbandman on which grounds to breed them.

The shorter the grass, the better is the taste of the rabbit. The drier the ground the better they succeed.

Of all creatures, water is the least necessary to the rabbit: tame ones will live altogether without it, on moist food.

Where

Where the soil is dry, the air fine, and the water that there is in the way is running and clear, rabbits may reasonably be expected to succeed best.

The wild rabbit will very freely be kept tame; and those which we usually understand as tame rabbits, will live as well wild, especially the hardier kinds. This is of consequence, because one of the tame kinds is better than the common wild one. This is the silver-hair'd rabbit. It will live and thrive as well wild as the common sort; and it is always better tasted and fairer to the eye, so that it brings a larger price. The skin also is of more value, and the demand for it among the furriers is certain.

In many cases it is adviseable to breed this wild instead of the other: but though it often is so, it is not always. This, though as hardy, requires a better supply of food than the other; and will be poor, and of little value upon those barren and heathy lands, on which the common wild rabbit succeeds very well.

The best place for this kind is a park, where it may run at liberty among the deer, and where there is good grass, though not rank: the other is the fit kind for the poorest lands.

C H A P. XXVI.

Of the tame rabbit.

TAME rabbits are distinguished according to their colours; but the differences are not great, nor is there any material difference attending the choice of one or the other sort.

The silver-hair'd rabbit, is a very profitable kind to be kept tame: The Dutch is a larger kind, and is very good for the table, but the skin is of less value. The most beautiful, when kept cleanly, is the white long-hair'd kind, by some called the Turkey rabbit; and by others the shagge; but if not kept very clean, it is subject to a disorder not unlike what doctors call the plica polonica; the hair growing together in clots and cakes, in such a manner, that blood vessels from the skin run up amongst them, and they will bleed on being cut off.

It is not material which of these, or of the other kinds it is a custom to breed at this time, the farmer chuses: with proper management, any of them will turn to good account; but which ever sort it be, let him take strict and critical

care in the choice : for a great deal depends upon it in this kind. The skin is of consequence, and the distinction in this are nice, and they are never too much to be regarded in the choice for breed.

In the silver-hair'd rabbit, let the husbandman take care to chuse his buck of the true kind and colour. Let the fur be thick, deep, smooth, and glossy ; and let the ground colour be black, with a moderate quantity of white hair. It is best to chuse them rather dark, for breeding, because the colour in the young is more apt to grow paler than deeper ; and a silver skin that is too dark, always will bring a better price than one that is too light.

Let the fur of the several other kinds be examined also, when they are chosen for breeding : the largest and best shaped should be fix'd upon. In the same manner, let them be picked out from time to time for keeping to preserve the breed.

There are several methods for breeding and keeping of them. Some allow more and some less liberty to the animal : in general, such as allow most freedom, even in this way, and most air, are best, for though the rabbit will bear confinement, yet it will thrive best where that is least strict.

Cleanliness is a great article : and where the confinement is least strict, there is naturally least foulness. The dung and urine have a disagreeable and rank smell ; and nothing prejudices the creature more than being kept nasty.

The general way of keeping tame rabbits is in boxes : others keep them in pits ; but it would be a much better way to have buildings made for that purpose. This might be done at a small expence, and they would be cleaner and more wholesome than any other way. Boxes are too small, and apt to grow nasty, and pits are liable to be damp, which is one of the worst things that can happen in a place where rabbits are to breed.

The boxes should be made of thin wainscot, and divided into larger and smaller rooms, two for each rabbit. One for eating, and the other for lodging and bringing forth the young. That for eating should be the larger, and should have a grate before it for light, and the smaller should be entirely dark. Before both there must be placed a trough, with the food ; and thus the creature will live, thrive, breed, and fatten. But there wants free air, and it is very difficult to keep them cleanly.

Those

Those who use boxes, set them one above another, in so many stories; and keep the bucks, and the does by themselves; unless it be such does as have not bred; and with those they lodge a buck in the same box. The common size is two foot long, the same in breadth, and a foot high. It is surprizing to see a rabbit live so well in this small compass; but it will always do better when it has more room.

The method of keeping them in pits, is thus. A dry soil is to be fixed upon, and the pit is to be dug seven foot deep, and of a bigness proportioned to the number. This must be walled up on the inside, only leaving spaces for them to make their burrows. A sandy soil, not too poor, is better than any other. At one end an hollow place is to be made for the buck to rest in, he must be chained to a stump, and have room only to go to the rack where the food is placed in these pits, and thence to his den. In other parts of the pit, out of the reach of the buck, are to be the places left for the does to make their burrows. The rack is to be plac'd near the middle of the pit, between the buck and does, he being on one side, and they on the other.

Three does may be kept in the same pit with one buck, and for this purpose it should be ten foot square. Some make them larger, and keep more bucks than one, but it is a better practice to make more of them, only allowing one buck and three does to each.

This will appear a large provision for three or four rabbits, but it very well answers the expence. They live more comfortably than the other way; and the product is so great that one buck and three does will bring a hundred and fifty, two hundred or more young ones in a year.

The young are to be left under the care of the dam, till they are a month old, and they are then to be taken from her either for sale or the table.

The same practice is to be observed in removing the young, if they are kept in boxes, or whatever other way. When the old ones have brought forth a second brood, the first is to be taken away, and reared up elsewhere. The common way is to remove them to other boxes, keeping those of several broods of about the same age together: and thus they are to be treated in the other way, either rearing them in another pit, or in any manner that is convenient, only allowing them some room and air.

The reason of chaining up the buck rabbit in the pit, and keeping

keeping him separate in a box, is his mischievous disposition, for he will kill all the young ones. This the does are so sensible of, that in their natural wild life, they hide the young ones, and close up their holes, that the buck may not find them.

The two great requisites in the pits are warmth and dryness: their depth, unless the ground be very favourable, making them subject both to damp and cold.

The most profitable time of their breeding is in the depth of winter; and they will never breed at this season successfully, unless they be kept dry and warm.

CHAP. XXVII.

A profitable method of keeping tame rabbits.

FROM the danger of the cold and damp in pits, and the want of air in boxes, I have been led to think of such other methods as may give the rabbits the advantage of both in a fit degree, and yet keep them in such an easy and ready way, that they may be always at hand, easily fed, tended, and looked after in every respect, and yet have warmth and freedom.

To obtain these advantages, by means of which tame rabbits of the best kinds will be kept in the greatest perfection of health and beauty, let the husbandman erect a building purposely for them.

Let him fix upon a proper spot of ground for his edifice, and draw the plan of it of such extent as to contain the number he thinks proper to keep.

Let the soil be a dry loam; for this is the sort of earth the rabbit loves best, and in which it is always most healthy.

Let the building be square, and run up of wood in a slight but yet tight manner; and let there be a kind of closet carry'd up at one end.

In each corner of this square let there be a den for a buck rabbit, and a small post driven in, to which to fasten him by a chain, in the same manner as in the pit. At some small distance from the corners, let there be racks set up for food, which shall be within the reach of the bucks; and one or two others in the middle.

When the house is prepared, let the bucks be chained in their places, and the does turned in. They will all live much more comfortably than in the pits; and at the times of taking away their young, let them be put into the smaller
rooms

rooms or closets, prepared for that purpose, where they will live and thrive very comfortably. Such a building will cost little, and the profit from the rabbits will be greater than any other way; because they will breed freely throughout the winter; and neither the old nor the young, will be subject to diseases. They will also be defended better against vermin than by any other way whatsoever.

The feeding of the rabbit is an article of consequence, with regard to its health and increase: some feed them almost entirely with wet meat, others almost altogether with dry; both are wrong. A mixture of food, keeps them better in health, and occasions their breeding faster.

The dry meat of the rabbit is hay, oats, and bran. Their moist food is fresh herbage, or roots, which they will eat with the greatest eagerness, as coleworts, parsley, &c. from the gardens; and sow-thistles, mallows, and the like, from the fields. These I would advise the husbandman to give them interchangeably; always observing, that when he gives them dry meat, he must set them water; and when they have the fresh meat, they have no occasion for any.

It is a custom with many to cut up the fresh food for their rabbits from under an hedge, taking every kind of herb so it be young. The rabbit will eat almost any; but some caution is necessary, hemlock is common under hedges, and is poisonous; the rabbit will eat it greedily, but it dies by the effect.

The hay that is given to rabbits must be the finest, sweetest, and shortest that can be got. Nor let any one grudge the expence, for they eat little.

This is the best and healthiest food for rabbits, and should be their standard diet; but about once in five days they should have fresh herbs, which cool and scour them. By this management they will be kept healthful and vigorous; always ready for breeding, and their young will be lusty, strong and thriving.

Among the other food of the rabbit should be mentioned grains: this is of a middle nature between the moist and dry; and is a very cheap diet; but it is not wholesome, and therefore is dearer in the end. The rabbits will seem to thrive upon it, but no food makes them so liable to diseases.

The advantage of their dry meat is, that it prevents disorders: and those who commonly keep them upon fresh and moist food, giving them carrots and other eatable roots among it, would do well to change it for dry in wet weather:

ther : moist food is the great cause of these creatures having the rot, and they are most of all subject to this in damp seasons.

BOOK V. PART II.

Of Fowls.

C H A P. XXVIII.

Of the cock and hen, their kinds and choice.

THESE are animals of smaller size, and less advantage than the capital articles of the farmer's stock, yet not to be neglected. The hen, when considered with respect to her eggs and chickens, not to mention her body, and the feathers, affords an article, though small in comparison of some among the preceding, yet worthy of the farmer's careful regard.

Though the profits are small, in proportion to those of the ox or sheep, they come easier. There is less trouble and expence in these creatures, even than in the rabbits. They in a manner take care of themselves; feeding the scatterings of the barn, with little assistance; and maintaining themselves even where there is not this, by their own care, with very little help.

Fowls are a stock the poorest may keep, and such as the richest should not neglect; they are universal, and they very well deserve to be so: they are a comfort to the peasant, while they add their profit also to the general purse of the wealthy farmer.

The husbandman is to provide himself with cocks and hens as a needful part of his stock, and he need not be afraid of overdoing in this article; these are not like those creatures, numbers of which require great attendance, and rich pasturage: a very considerable quantity of them will provide for themselves in his yard, and at the barn door, for the greatest part of the year, without doing him any damage, and will be supported during the remainder, at a very small expence.

The advantages they afford are in a manner continual: they are a constant supply for the family, and market; where, according to their management, they afford a larger or smaller price.

The value of every thing rises in proportion to the demand; and on this will depend the particular directions for

for the farmer in this article. The great demand for fowls is in large towns, therefore he ought to proportion the quantity to his situation. If he live in a lone place, it will not be worth his while to keep more than will serve for his own family, and for a few of his neighbours who may purchase of him: but if he be situated near a market town, especially if within a due distance of London, he may stock himself as largely as he pleases: the greater number the more the profit. There is there a constant market throughout the year, for one kind or other.

Additionally to this, he has their feathers and dung.

A great deal depends upon the first choice of fowls, for the whole brood to come is to be of the same kind with the parents.

The industry of those who breed poultry, has of late years greatly multiplied the breeds: but these differences are not so great as many imagine. They arise from small distinctions, and will sometimes go off in the continuance. Between the Darking fowl, and the little Bantam, there are many degrees in bigness: and the game breed is altogether distinct from both.

Among the several breeds, let the farmer consider which will best answer the demand he is like to have for the produce: only in some measure, indeed, he is to be guided in this by the circumstances of his farm. He who has a good barn door, and a rich yard, may keep a proper quantity of the largest breed in health and vigour: the common or smaller kind will succeed best with the peasant or the poorer farmer, for they will support themselves by running about the roads and hedges, eating insects, seeds, and whatsoever can afford a living creature nourishment.

Upon these two considerations the food and the demand, the husbandman will be able to know which breed it will be his interest to take.

Which soever kind it be, let him observe these marks of goodness.

Let the cock be large for his kind, well shaped, and lively: the cock is naturally an upright, stately, and majestic bird; when he appears without these characters, 'tis a proof something is amiss. The cock that does not strut, is not fit for the father of a brood. He should be long in the body, and thick in the garth. His neck should be long and naturally arch'd, free in its motions, and well covered with feathers. His comb and wattles should be large, and of a bright

bright red; his eyes full and sprightly, and their colour answerable to that of his feathers. His beak should be strong and hooked, his legs sturdy; his spurs long and sharp, and his claws short and strong. As to colour, the two best are the red and the white: the red is fittest for a stout breed, and the white for a more delicate.

In the choice of the hen, the same general marks are to be observed, only her aspect should be mild as the cocks is sturdy. She should be lively and well coloured; her claws short and strong; and if she want the hinder claws, it is so much the better.

When the fowls are thus chosen, let them be observed as soon as they are put into the ground, for if any thing be amiss in them, that is the time to change; and it is much better to sell the bad again, and buy others, than to sit down content with such as are not of the best kinds: the loss attending this can be little, and is but once; the disadvantage of having a bad kind is continual.

The cock should be busy and noisy: he should be often crowing; and from time to time scratching up the ground to turn up worms and other food for the hens. The hens should be brisk, but quiet; a crowing hen is as bad as a dumb cock: these neither lay any quantity of eggs, nor sit well.

If any of these faults appear in the fowls that are bought for breeders of a stock, let such as have them be changed; till such as are in every respect right, are obtained.

The proportions of the two sexes should be about one to ten: a single cock will serve twelve or fourteen hens; but the most profitable way is to allow a cock to every ten of them; and this way they will breed to the fullest advantage.

C H A P. XXIX.

Of the breeding of poultry.

THE yard being stocked with poultry in proper number, of the fittest kinds, and with the choicest of the breed, the next care is the managing them to the best advantage for breeding.

The age is a considerable article; and their employment must be suited to that: it would be ill husbandry to stop the profitable laying of a hen, by setting her upon her first eggs, when there are such as are fit for nothing else, and will do this better.

The

The youngest hens are the best layers, and those advanced into years are the best sitters. In both of these respects the farmer is to have regard to the feeding: any extremity is wrong, whether in excess, or in defect. If they be starved, they will want strength; and if they be fed too high they will grow fat. A fat hen is always lazy, and will never lay well, nor sit quietly. The feeding them moderately is the only right method.

The best season for sitting, is spring or summer; the earlier in summer the better, and the first months in spring are best of all. March is the best month for chickens to be hatched. The hen sits only twenty days, so the husbandman will know when to put her upon the eggs for the best brood: that is in the last week in February; and from that time he may continue breeding till the first in October.

He should never set a hen that is less than two years and a half old; from this time to five, or between five and six years is the best for producing chickens. The finest broods will be obtained when a hen of a good breed, and of about three years old, is set in the middle or end of February, upon a parcel of well chosen eggs laid by a young hen of a good kind, who has let no cock come near her but her own.

That in order to the having a due quantity of eggs, the hen that lays must be fed moderately. But there is something to be said for the kind of food, as well as the quantity.

The pretences of increasing the laying of hens by particular diet, have been slighted; but they have been since confirmed upon repeated trials; and no argument can stand against experience. The two best food are buckwheat and hempseed. The effect of these is equal in respect of laying; but the one fattens at the same time and the other does not, therefore the condition of the hen is to fix which is preferable.

If she be inclined to fat, Buckwheat must not be given, it will encrease her fat so as to take her off: in this case hempseed is the proper kind. On the other hand, when a hen is poor, the proper kind is buckwheat.

The best number of eggs to be put under a hen for setting, is seventeen. They must be fresh and sound, and let the upper side of every one of them be marked blue; when the hen gets from her nest for feeding, see if she have turned them all, or any of them. Such as she has not turned, the owner must turn for her. From this he will know how to value her for setting afterwards; for the hen that turns all her

her eggs herself, is greatly preferable to those negligent ones which omit it.

To judge of the soundness of her eggs hold them up to the light, and see that they be full and clear.

When a hen is set, she must never be disturbed against her will; and care must be taken to set her food and water. If she be put from her nest, she often forsakes it; and if she be obliged to go to seek for food and drink, oftentimes she is obliged to be absent so long, that the eggs chill, and the chickens are killed in them.

This care is needful during the whole time of her setting, but most of all toward the end. The chickens are then formed, and they require the constant warmth of her body to keep them alive, a small time of chilling will utterly destroy them.

When the hen rises from her eggs, to feed upon what is set before her, some person should stir up the straw of her nest and lay the eggs regularly together, that she may find all agreeable at her return.

The cock is to be watched upon these occasions, for when the hen is off her nest, he will offer his service to set for her, but he does this very awkwardly, he frequently breaks some of the eggs; and the hen is always displeased at it.

In the choice of eggs for setting, if there be any larger than usual, they are to be rejected, for they will not lie even, and will cool those that are next them. These often have a double yolk, and they are the eggs which produce misshapen chickens.

As nothing more is requir'd for the hatching of chickens than a due heat, there has been long a custom in Ægypt, of hatching them without the help of hens, in ovens, by means of a small and regular fire. They produce in this manner vast broods at a time. This custom has of late been brought into Europe; in France Monsieur de Reaumur made many experiments, and at length with some success. From the publick account he gave of this, the same has been attempted in England, and among other ingenious persons, the honourable Mr. Stanhope tried it, and succeeded: but there does not seem any probability of its being brought into common use: indeed so much nicety is required, and such a great deal of care of the chickens after they are hatched, that it appears rather fit for an amusement for the curious, than an employment for the husbandman.

If a hen dies, or a brood become by any accident motherless,

therless, mix them among the chickens of another hen that are about the same age, and she will take care of all together. A hen may thus be brought to conduct three or four broods: and this is the most favourable circumstance concerning the hatching of eggs by art; but there is a limitation in the number; and at present the attempt is not to be recommended to any on the foundation of utility or profit.

Although we have fixed the setting of the hen to the summer and spring months, it is not to be understood that they will not set at other times. Eggs may be put under them at any season of the year, and they will hatch them; and for those that chuse to bestow a sufficient attendance, the winter broods may be worth raising, for they bear the best price when they are grown up for sale in spring. This, however, requires more trouble than the husbandman can well bestow upon so small an article; and it is therefore we have recommended the setting of the hens in the end of February to any other time.

When the breed of chickens is the only care, the white fowls with white legs and white beaks are to be prefer'd, because of the colour and tenderness of their flesh, but these are not the best layers.

If eggs be the principal care, the red cock and mottled hen are to be prefer'd.

If a hen that has been fed with buck-wheat, to make her lay frequently, grow too fat upon that diet, she must be fed with oats: for at the same time that they take down her fat, they assist her breeding of eggs.

It is not intended that the fowl should be kept upon these things entirely. She should be left to take some care of herself abroad, for her stirring about will do her service; only what addition to her natural food is requir'd to keep her in health and strength for laying, should be of these kinds.

C H A P. XXX.

Of the bringing up of chickens.

WE have led the husbandman, or rather the good housewife, (for this care naturally falls upon her) from the purchase of this stock, to the hatching of the young brood. These are the most essential as well as the most valuable articles under this head, and we shall therefore lay down such rules for the breeding them up, as experience has shewn are the most useful.

Twenty days is the smallest time the hen sets: some eggs are longer than others according to the thickness of the shell, their place under the hen, or other accidents, and they sometimes are one and twenty, and sometimes two and twenty days.

In this, patience is the remedy. There have been several ways proposed of assisting the hen in hatching, but they are foolish and unnecessary. All should be left to nature.

In large broods, it often happens that some chickens are hatched a considerable time before the others, often one, and sometimes two days. In this case let the hen be watch'd to see how she treats them, for if she be careful, nothing better can be done than to leave them with her. But if she be restless, and seem troubled with them, it will be best to take them away.

Let a little wool be put into the bottom of a sieve, and let them be set in the reach of the warmth of the fire; and thus nursed up till the hen has hatched the rest, and can take them under her care. Nothing is needful but to keep them warm: the chicken in the two first days requires no food.

For the first feeding of the chickens, the best thing is a mixture of white bread crumbs and small oatmeal. Let a quantity of these be mixed up, and then put a part of it to steep in milk, and keep the rest dry. Give the chickens a little of each sort at times, as they follow the hen.

After they have got a little strength, they are to be fed with bread steeped in milk, and then with barley-meal and cheese-parings cut small, and the like, and the hen will by this time greatly assist in the providing for them, tho' at the first she can do little more for them, than the keeping them together, and nourishing them by her warmth.

In cool weather it is best to keep young chickens within doors, till they have got some strength. At the worst season, during the months we have recommended, they need not be kept within doors above ten days; in the better, less keeping them within will be necessary; often scarce any at all.

Chickens, while they are young, must have good water: they fall into half the diseases to which they are subject, from the being obliged to drink foul.

By the food we have directed, and giving them bread, scalded with milk, and barley meal afterwards, they may be fattened while under the hen. This is a very common practice in Ireland, and according to the common error of
expression

expression in that country, they call these sucking chickens.

The most useful time of fattening them is, a more advanced growth. When the hen forsakes them, which she does as soon as they are able to provide for themselves, they should be taken up and put into coops, in a darkish place, and there fed fourteen days. Their quietness assists, and they will be most quiet where they have least light.

They are to be fed by cramming, and the best food is wheat flour, made into a paste with milk. This is to be soaked in milk and then broke into small pieces, which are to be put down their throats, wetting them well in milk, that they may go down easily.

Some prefer barley meal; and others speak greatly of the meal of buck-wheat: but buck-wheat does not answer well alone. A little of it mixed with the wheat flour, may do very well; but too much is not profitable.

One thing ought to recommend this greatly, the advantage of their dung. The price they bring will very well pay the expence of feeding them, and he has this addition to the profit. We have mentioned the dung of poultry, and here it is naturally collected together, and he may use it before it has lost any part of its virtue.

C H A P. XXXI.

Of capons.

THE capon, is the cock gelt, and fed properly. The time for gelding is either as soon as the hen has left him, or if the testicles be not come down, as soon as he is heard to crow.

The gelding is called carving: there is nothing particular or difficult in it. The testicles are to be cut out, and the wound heals of itself.

The hen being spay'd fattens in the same manner, and becomes a very fine fowl.

The capon will grow to a fine size and delicate flesh in the yard, and at the barn door: but if some meat be given him beside, he will come into good case the sooner, and thus be very well fitted for the table. To make him bring the largest price, he is to be cram'd in the manner of chickens.

To cram capons, let them be kept in a small, quiet, dark place, and fed in the way of the chickens; their dung is to be saved, being of great value.

The best food is barley meal, with milk mix'd into a kind of paste, of a moderate stiffness. This is to be shap'd into long pellets, largest at the middle, and smaller at the ends; these are to be wetted in warm new milk, and he is to be fed with them three times a day: for eighteen or twenty days.

Regard should be had to the dung, for knowing the capon's health. The finer the meal is sifted the sooner it passes through him: so that by giving it finer or coarser, he may be kept in a proper condition during the time of his cramming.

If the husbandman live where there is not a demand for capons, it will not be worth his while to cram any; but still he ought to breed some among his stock, because they will come into a very good condition for his own use, by feeding in the yard; and they may also be put to a very considerable service, in the breeding up broods of chickens. The capon is to be tricked into this at first; but when he has once well taken to it, he will be pleased with it.

The large bulk, and soft flesh of this fowl is a great advantage, for he is able to cover a larger number of chickens than an hen, and he will keep them warmer.

The thing that tempts the capon to take this charge upon him, is the pleasure of feeling their soft bodies.

The good women sting the breast and belly of the capon with nettles, pulling away a part of the feathers for that purpose: they do this toward his roosting time, and then in the dark put the young brood under him, the warmth of their bodies allays the itching, and when he sees them in the morning he takes to them, and will lead them as a hen.

This is not limited to chickens; the capon will lead young turkeys, peahens, pheasants, ducks, or partridges, and will be better to them than their natural mother, fighting any of their enemies, and sheltering them on every occasion. If he grows negligent of them, the method is to sting him again, and he will take to them as naturally as at first. Some scratch the capon with briars, or prick him with furzes, to this purpose, but these are cruel ways, and do not answer the purpose so well.

Before we close this head of fowls, it may be proper to give the good housewife one caution about the collecting of her eggs, especially when she has a large stock of poultry. They should be taken out of the nest every day, and the proper time is the afternoon, when the hen has left them. The nest egg is to be left, but never any more. In the place of

a nest egg, some cut a lump of chalk into the form, and it answers the purpose.

Many hens make a cackling as soon as they have laid, and shew the time to go for eggs, but they do not all do this: and the best way is to have one time of the day to go for them.

The keeping eggs a long time, has employed the thoughts of many, and several methods have been proposed, many of them idle enough, but some useful. They have been laid in straw and in bran: but the first keeps them too cold, and the latter too hot. Putting them in malt has been found preferable to either. But the best way is by dipping them in fat.

An egg spoils by the wasting of its moisture through the shell, and this is prevented by any thing that will stop up the pores. No method answers this end so well as covering them with some fatty substance; and the best way of doing it is by melting a quantity of fat over the fire, and dipping the eggs in it. They will bring away so much as will cover the shell sufficiently.

We owe this to the French, and it has been discovered by their philosophers: in that country the greatest men are not ashamed to meddle with the meanest subjects that can be of publick utility.

C H A P. XXXII.

Of turkeys, their kinds and choice.

THE turkey is a large fine bird, and well worth the regard of the husbandman. There are disadvantages in the raising of this, as other kinds of fowl; but the benefit far outweighs them.

A great many of these disadvantages, may be prevented by prudent management: and that there is no kind of poultry which will afford so many opportunities of improvement. There are breeds of the turkey, much more different than those among the cock and hen; and the proper choice, will greatly add to the profit of keeping them.

The advantages of the turkey are his size, the price at market, and his dung, which is as valuable as any other kind whatsoever. His feathers also are not to be neglected, in counting up these benefits.

Among the disadvantages are to be reckon'd their straggling disposition, their being liable to many accidents, the difficulty of raising them, and the frequent destruction by ver-

min ; as also the quantity of corn they devour. If they were fed altogether with this, they would eat more than they could be worth ; but feeding them with corn is not necessary, for they will in general provide for themselves.

The turkey succeeds best in open countries, because these are not so much infested with vermin : this may be a reasonable caution for the husbandman not to keep them in improper places ; but we have counties enough in England that are proper, the farmer is always to suit his stock to the nature and circumstances of his farm.

There are many differences among turkeys, in colour and other accidents ; but there are also distinctions of more consequence, as they depend upon real differences in the kind. Among the common breed there are two sorts, distinguished by their colours, a grey, and a darker. The white kind breed excellently, but they are tender, and the others require less care, but they do not hatch so many young.

The turkey kind take very little care of their brood : but these least of all. If a common turkey, of the white kind, have a large number, she will not miss half of them, so the rest keep about her ; but among the black, if a single young one follow the hen, she never thinks of the rest, if they be all lost ; and even this she will drop with very little regard or notice.

If the farmer intend to bestow a great deal of care upon his turkeys, the white kind are to be prefer'd : but if he cannot allow so much time, let him chuse the black : all that is necessary is to see they are not deserted while they follow the dam, for after this they will take care of themselves.

There are turkeys very different from these, the wild turkey of Virginia is very valuable : it is large and dark coloured. There is also a smaller wild kind, of a dark colour, that is much hardier. Either of these may be raised by the farmer ; or he may mix the breed by coupling one of our common turkey cocks with a hen of one or other of these kinds. The English and Virginian turkey make a very good breed, as has been found long since by experience. The young are hardy, and will soon take care of themselves ; and they are larger, and every way better than the common breed. These will raise their young ones in the fields, and bring them in at an age when they can shift for themselves.

Whatever breed the farmer shall prefer, let him chuse such

such as are good of the kind ; and particularly the cock. He must be a tall, stout, lusty, and spirited bird. The turkey is naturally stately, and majestic ; and the cock that is chosen for the breed ought to be so particularly. If he hang down his head and look peaking, he never will be good for any thing as a father for the brood. The hen should be large and vigorous ; and such as are tamest are the best for the care of their young.

C H A P. XXXIII.

Of the breeding and raising of turkeys.

IN breeding of turkeys the age of the cock and hen must be regarded. The cock must be young, for the brood is never good unless he be in the vigour of his life ; the hen may be older, for her care in sitting and leading them is all that is required of her.

The cock should be about two years old ; and the best age for the hen is at about four years : she may be employ'd in breeding till six ; but when she is youngest, she is most apt to neglect the brood ; and when the cock is at all declined from his strength, they are weakly.

Turkeys are not natural to our kingdom, and there is always a wildness about them. The female does not lay familiarly about houses, but rambles to a distance, and makes her nest among thickets : for this reason her brood is more liable to accidents. The farmer must be watchful about the time of her laying, and get her into the hen-house, and compel her to lay there.

If there be convenience of thickets, or a little wood near the house, some let them take their own way, and lay and sit there ; and in the hardier breeds, with a little care of the young when new hatched, this will do very well ; but there is never any harm in the other method, and there is a greater certainty of success.

The turkey begins to lay in March, and will sit in April. The eggs are large, and are excellent as food, particularly they have a restorative virtue.

The proper number to let the hen sit upon is eleven : some advise thirteen, but there is less success in that method, for they cannot be all covered.

In directing the quantity of eggs to put under a hen fowl of any kind, we speak in odd numbers, as eleven or thirteen, not naming ten, twelve or fourteen. The reason is,

that an odd number will lie better, and in a more compact heap, when we come to such quantities, than an even. This is owing to the shape of the eggs, and is a fact any one may see on trial.

The turkey sits seven or eight and twenty days. Some of the eggs will be hatched at five or six and twenty, and some will lie till thirty, but the middle time is the most natural.

The hatching is the time when the greatest care is required. The turkey being a bird of a warmer climate, is chill in this; and particularly the tender young. They must be kept carefully at first, especially such as happen to hatch before others. The best way is to put them into a basket with wool, and set them before the fire, at such a distance as to be gently warm'd.

From this time some body must act as a parent for them, for the hen is not to be expected to do much: they will follow her, and should be permitted to do so in the warm part of the day: the cock will watch over them, keep them together, and defend them better than the hen, but neither are to be trusted without careful looking after.

The proper method is this. They are to be kept in a warm and close place altogether while they are very young; and when they have got some strength, they are to be let out two hours after the sun is up, and taken in again before it sets.

At first they are to be fed in the house, and afterwards in some open but secure place: and at all times they must be allow'd sufficient food, for their parents take little care to help them to any. The best food is green fresh cheese, and while they are young, their drink should be new milk; afterwards milk and water, making it weaker till they come to water alone, which they will then drink wherever they can find it. Curds are a good food, but not so well as cheese. A wholesome food also is a thick hasty pudding made of oat-meal, water, and a little new milk.

As the tenderness of the young is one great disadvantage in the turkey, care must be taken that the hen do not set herself too soon. If the young are hatched in cold weather, it is scarce possible to rear them: but if they be produced toward the latter end of May they will have a better chance.

It is only while young this bird is so exceedingly tender; for, when grown up, it will bear the coldest of our weather very well. Grown turkies stand our severest winter nights

nights exposed, better than common fowl. They are frequently subject to be lost while young, by straggling from the dam, and one another, but it is only while young they are liable to this; for, when grown up, they are strong enough to defend themselves; and they always love to keep together.

The husbandman who has many turkeys, must take a care to keep them out of his garden: no bird does so much mischief there. But their profit is very well worth the trouble they occasion in this and other articles.

When young turkeys have been raised to some strength and bigness, they may be left to themselves. They had reason to complain of the expence of these fowls, who fed them constantly with corn; for they are great devourers: but we find by experience, there is no occasion to feed them, with that or any thing else, till they are to be made ready for sale. They will at all other times take care of themselves, and keep in good case with what they find under hedges, and in the yard.

They are naturally fatter in winter than summer; for they are an indolent bird, but the cold gets them a stomach: and this is the best time for feeding them for the market.

To do this they must be housed; but it is best not to keep them up entirely, for they will in that case lose their appetite, and come on poorly. They must be let out the greatest part of the day, but it is best to keep them where they cannot run much about. The food to begin fattening them with is good barley, boiled till it is soft: Oats will do; but barley is better. Let them have plenty of this a fortnight, with some air and sunshine, but a great deal of rest. After this they are to be cram'd every morning, with a paste made of barley-meal and new milk; in long pellets, wetted in warm milk to make it go down. They are to be well fed in the morning, and then suffer'd to go out, but they are to be kept as quiet as may be. They are not to be cram'd any more that day, but during their being out, corn is to be thrown to them at times: this will keep them feeding, and keep them quiet, and thus they will in a little time fatten up in a very fine manner.

This is their right management from the egg to the preparing them for the market; in which all the disadvantages supposed to attend them, may easily be obviated and prevented; and that all the care that is needful is, when they
are

are very young, and when they are preparing for the market: at the first of these times the least cold kills them; and at the other, they will not fatten unless carefully tended: all the rest of their lives they provide for themselves; and the price they bring, whether sold as poults, or when grown up and fatted, is so considerable, that it very well answers all the trouble.

C H A P. XXXIV.

Of geese; their kinds, and the profits of keeping them.

THE goose is different in its nature from the hen and turkey, they living on land only, and this, part of its time in the water; for which it is qualified by the nature and make of its feet contriv'd for swimming.

The husbandman must consider, how he is situated with respect to water before he determines on this head. Of the several water fowl that are bred tame, the goose is least devoted to that element, as it walks well on land, and finds most of its food there. Geese will live where there is little water: but though they will live where there is little, they thrive better where there is more.

The husbandman is to consider, when he is about to raise his stock, what kinds suit best the nature of his situation; and from this he is to be led in his choice which to have in the greatest number. Where he has little water, he should breed some geese; but where he has much of it, he may fall greatly into that way.

Some may fancy it less worth while to be careful about these, because their profit is less than from the hen or turkey; but the trouble is also less: and their value is not so small as some affect to make it. They are sold at a good price in spring when they are young, and in autumn when full grown; and beside this, there may be a great profit made of their feathers: many millions of geese are raised in some parts of this kingdom for no other use.

We shall advise the farmer, who is conveniently situated for the breeding of geese, to look upon them as an article of some consequence; and we would have no one who has any quantity of water at all, utterly neglect them.

There are three or four breeds of geese, though not so much regarded as the differences among other fowls. We have also some others of curiosity, but they are not worth the husbandman's consideration.

The

The large grey goose that is bred in the fen countries is preferable to any other, both for flesh and feather, and it grows to the biggest size of any. We have a small grey goose, and a small dark colour'd. Neither of these are so advantageous as the grey; and among the large kind that are so call'd, those are much better which are all of a colour, than such as are pyed or mottled.

Some of these breeds are more under a necessity of water than others. The small bodied dark colour'd goose, will do where there is ever so little, but they are the least profitable. The large grey goose requires to have plenty of water, nor does it any where succeed so well as where there are running streams: the lesser grey, which is often pyed, will do with less than this, though it will not thrive unless there be some plenty.

Therefore if he would have many geese where there is not much water, he should chuse the small grey kind; but when he has water enough, let him always breed the first mentioned sort.

Another advantage for the breeding of geese, is a good quantity of common: they will on these places provide for themselves, without the trouble of the owner; and it is on the common fen lands in Lincolnshire, and the adjacent counties, they keep those vast droves of them, for the sake of their feathers. They pull these once, or twice a year, and find a ready market for their produce.

Nothing agrees so well with the goose as plenty of room, on a damp common. They will breed of themselves once a year, and in some places twice, bringing up the broods with less trouble or loss than any other fowl.

The natural time of the goose's breeding is spring, and the earlier it is the better for the owner. The farmer who keeps them about his house, should bestow some attention upon this head.

Some geese will not lay above nine or ten eggs, others seventeen: they rarely exceed that number; and if they do, the best method is to take some away before they sit. A goose will cover fifteen, seventeen is the utmost she can. There commonly is better husbandry in setting her on fifteen: for when there are too many, they only cool one another.

That goose is best which lays earliest; for the green geese will be ready in the dearest season; and she has the best chance for a second brood that year.

There is an opinion, that if the gander treads the goose
on

on land, the eggs do not answer so well as when the copulation is on the water. From this they attribute the frequent failing of early eggs, to the waters being frozen over when the goose was trod; but this is idle: the misfortune is owing only to the coldness of the season.

C H A P. XXXV.

Of the breeding and feeding of geese.

WHEN the goose is about laying, she carries straw about continually for making her nest: and the owner will do well to assist her. Let him find out a convenient place warm and quiet, and there make her a nest of straw and nettle roots: she likes the smell, and it does good to the young.

When he observes she continues upon the nest a considerable time after she has laid, it is a proof that she is about to sit.

The goose must sit upon her own eggs: she will not do it well if she perceives any deceit, though they be of the same kind.

Geese succeed well enough that lay where none know of it, yet they will be greatly assisted, and the brood from the same number of eggs, will be larger, if the same care be taken of them that is allowed to other poultry.

The careful housewife when her goose rises from the nest, will set a quantity of proper food before her, that she may find it without trouble; and some large vessel of water that she may wash herself. The best food is bran scalded, or oats; when she sets near a pond or river, she should not be hindered from bathing herself, for she will not sit kindly if she be not allowed to follow nature; and this bathing of herself at large is much better than the washing in any vessel that can be set for her.

While she is off her nest, it is fit to turn the eggs, if she have not done it herself: and when some hatch before the others, they should be kept in wool, in a warm place, till the others are hatched.

The time of setting is from six and twenty to thirty days according to the season.

Let the goslings be kept within doors ten days; and fed with barley-meal in milk, or ground malt, or curds, or bran scalded with milk. After this they should be suffered to go out in the middle of the day; and at about a fortnight old,

the goose may be suffered to entice them to the water.

They are to be tended and fed occasionally, till they have strength enough to defend themselves against vermin, and to provide for themselves. For several days after their first going out, they should be brought in at night, and somebody should watch them, for they are poor defenceless creatures, and a prey to every thing: but when they are so far grown as to feed well, and walk stoutly, they may be left to shift for themselves. With less care than this broods of geese will often succeed very tolerably; but this ensures their safety.

There are two periods at which the goose is fatten'd for market: first, when it is very young. It is distinguished at these times by different names, the green goose, and the stubble goose.

The right age for taking up the gosling to fatten it for a green goose, is at five weeks. The best food is ground malt, or oats, boil'd in good plenty three times a day with milk, and milk and water for drink. If they be shut up in a quiet dark place they will thrive the faster; and may be brought into condition in a fortnight.

For fattening the stubble goose, the same method and the same food are to be used, and in a fortnight or three weeks, it will be ready for the market. Taking them up soon after the harvest season, is a favourable time; because in running in the stubble fields, they will have got into tolerable flesh; and then being kept quiet, and dark, and well fed with the nourishing drink of milk and water, they soon fatten to perfection. It is a good custom to put a little barley-meal into their milk and water, and to let this stand constantly before them: it will encrease the power of the food in getting them into the due flesh.

The natural food of the goose is principally grass. They live very well in commons and waste places, where there grows little or nothing else, during the greatest part of their time. The stubble fields are a great advantage to such as are to be fattened: for the food they pick up there from the scatterings of the harvest is richer, and tends more to the nature of that of which they are to be fed when put up for that purpose. The proper goose for feeding up in this manner is one hatched the foregoing spring, that has run among the stubble about three weeks: this takes to feed kindly, and grows fat soon.

The proportion in this kind is properly one male to five females. To a flock of forty geese, which is a very good number,

number, there are to be eight ganders: more will be superfluous, and with a smaller number they will not breed to the full advantage.

If while a goose is in fattening it nauseates its food, and does not thrive, let there be set before it a dish of small and clean gravel. This will recover its appetite.

C H A P. XXXVI.

Of ducks.

THE duck is designed partly for land, and partly for the water, but it is more of the water kind than the goose. It not only has feet form'd for swimming, but the legs are so placed that it walks badly; and is naturally more in the water than on land.

The husbandman will perceive that whether he shall keep ducks, or in what number, must be determined from the circumstances of his farm.

As the duck will be content with puddles, he may keep some wherever there is the least water; but where there is plenty, and roving room, the ducks thrive, especially where it is a running water.

If he is situated near a river, he is best qualified to breed ducks to advantage; and they have enough value to make it worth his while to breed them. He is not to count the price of any thing alone, in order to understand his profits; but its price compared with the expence and trouble: and he will find the duck of a very fair value: for as much as its price is less than that of the others, so much less is the expence needful about it; it is indeed so hardy, that it may be left to itself; and its young so early take to the water, that they are out of the way of most enemies.

The only time which requires care, is while the female is sitting, being then kept from going in search of her food, she will need to have some set before her: but the coarsest and most ordinary will do; at other seasons she will live very well upon the scatter'd corn about the yard, the offal of the house, and what the current of a running water is continually bringing down. Scarce any thing comes amiss to her; yet her flesh is delicate: she is less mischievous than any other fowl; she lays abundance of eggs which are as good as those of the hen, and she hatches very numerous broods, which are fit for the market at two ages, when young, and when grown up: and in either case are easily fattened.

There

There are several kinds of ducks kept in England; but the husbandman needs not give himself any trouble about more than two of them, the common tame duck, and the wild duck kept tame.

Of the tame ducks are several breeds, worth the farmer's notice, because of their different ways of living. The wild breed require more water, and the tame will do better than they to be kept in the yard. Among the tame, there is a narrow beak'd breed, which is hardier than the common, and will do with yet less water; and there is a breed that have the beak more turning up at the end: these are the better layers. They do not bring up their numerous broods so well as some of the others, but when eggs are the principal consideration, these are to be prefer'd.

The common tame duck does best in gardens and orchards, none is so cunning in picking up worms, snails, or other insects, or devours them in such quantity.

It is a great number of eggs that may be had in the season from the kind just mention'd; and she will in the end fit; though the others better. It is more profitable to set a hen upon the duck eggs, than any kind of duck whatever, because the old one leads the young too soon to the water; they follow the hen a good while upon the land, and get hardy before they venture.

Thirteen eggs is the best number to let a duck sit upon. The hen will cover as many of these as of her own.

When the ducklings are hatch'd, they require no care if the weather be good; but if it be a very rainy season, it is best to take them under cover a little, especially in the nights.

The fattening of ducks is very easy, and whether it be the duckling, or the grown duck, the method is the same. They are to be put into a quiet dark place, and kept in a pen where they are to have plenty of corn and water; any corn will do, and they will fatten themselves extremely well in fifteen or twenty days.

C H A P. XXXVII.

Of the keeping of wild water fowl; and of decoys.

THERE are several other water fowl, which people of curiosity keep in some places; and for which there is so good a price at market when they are by any chance brought thither, that it may be worth the husbandman's while,

while, where his situation is proper, to follow the method that has been taken by those who had no farther view, than to satisfy their fancy in keeping them.

These are to be kept in a manner wild ; though under the care of the farmer. They must have a place of security ; and opportunities of hiding ; they must not be disturbed by peoples often going near them ; and they must be fed as it were by stealth.

The great intent is to make themselves fancy they are wild though in confinement. Teal, widgeons, and many other kinds, may thus, where the farmer has the proper conveniences, be raised in a kind of wild state, and in considerable plenty.

The first requisite is, a spring of water, upon some level ground, that wets a moderate extent, and lies to some depth in different places : or else a part of the arm of some river, or rivulet, that the farmer has wholly at his disposal.

Let him fence the spot well round ; plant oziars in some parts, and encourage the growth of sedge, and all sorts of weeds in others. This will give the fowl many hiding places : the top is to be cover'd with a net. When all is thus prepar'd the wild fowl are to be put in ; and being kept very quiet they will breed and live comfortably. And thus considerable broods will be raised.

These will provide for themselves in a great measure. The food that is to be given them may be corn of the cheapest kind : it should be thrown down in two or three different places at night, when they are at roost, that they may find it in the morning. This will accustom them to come to certain places, and will give the owner better opportunities of knowing his stock, and of taking them when convenient.

When there are young among them there should be scalded corn thrown in, which the old ones will lead the brood to eat : no creature is more careful of the young, than these water fowl, nor are any birds whatever so soon able to shift for themselves.

This is the method of breeding these water fowl in small numbers, and somewhat of kin to this is practised in the fen countries, of taking them in decoys : which yields the owner a prodigious advantage.

The decoy is a watery place, well planted, of large extent, and properly disposed for the taking of such wild fowl as come into it. Nature generally has made the place, and all that the owner has to do is to keep every thing quiet about it.

it. This has no covering at top, nor fencing at the sides: its extent is sufficient to keep the thickest parts from annoyance, and all is to be open for the fowls coming in. There are nets planted in proper parts, and a number of decoy-ducks, as they are called, are continually well fed in it. These, though of the wild breed, are in a manner tame; they know the people and are not afraid of them; for they find they are well fed, and suffer no hurt.

These go out at times, and settling among whole flocks of wild ducks, lead them to the decoy, and swim before them into the nets: they know they shall not be hurt. The people take the wild ducks for market; and turn these loose for farther service.

C H A P. XXXVIII.

Of the swan.

THE swan is less profitable than the meanest of the others, and therefore, notwithstanding the majesty of its figure, is less worth the farmer's regard than any. It is kept rather for ostentation than use, and more properly belongs to the owners of waters than the renters of land. However, as it is a common bird kept tame, it might appear an omission not to have given some account of it.

The swan has been designed by nature for the water: it walks very awkwardly on land: but on its proper element it has great strength, insomuch that when the hen sits, the male who guards the nest, is often very furious; and at any time will defend himself against a middling dog; and often drown him.

Swans require a large compass of water, and do best upon rivers: for they are kept without charge. Neither are they so hurtful as those imagine who have been told they destroy fish: their natural food is grass and the fresh water weeds, that run at some little depth under the stream.

They require no more care than feeding, but being once put on the water will, in all respects, take care of themselves.

Those who are very tender of their swans will give them a little attendance while they sit, but this is not altogether necessary.

They chuse the place for their nest themselves, and this is so large that it is easily seen; if the owner would assist them, he is to do it by planting boughs about the place, if

not naturally shaded, and when she sits, he is to place some oats in a trough near the nest, that she may not be induced to leave the eggs too long in search of food.

The swan lays from six to twelve eggs: her common brood is four or five. If the eggs hatch nearly together the brood is the more numerous; if not, when there are four or five young ones hatch'd, she sets off with them, and takes no notice of the remainder. To prevent this the young ones may be taken from her as they are hatch'd; and she will then continue sitting to the last. These first hatch'd young may be preserved in wool, till committed to her care with the others.

The time of the swan's setting is from six to seven weeks, and often there will be some of the young hatch'd three days before the others. These when taken from the parents should have scalded oats and milk yet before them the second day.

The young follow the dam in the water, and sometimes get upon her back; and she is so excellent a guardian that she very rarely loses any of the number.

Those who are fond of uncommon sorts of food, fatten young swans for the table.

If the young cygnet be taken at once out of the water and dress'd, there is not so ill-tasted a fowl; for its food being river weeds, gives the flesh a rank taste; but when they are fatted for eating, they not only get a great deal more and tenderer flesh, but it is of a better flavour. They are much like the green goose, only larger, and coarser, and their taste stronger.

To fatten them they are to be taken from the parent at five weeks old, and put in pens in a quiet darkened place: they are to be fed to their full appetite with oats, and to have milk and water for drink. In a month, they will be fit for the table.

C H A P. XXXIX.

Of the peacock.

THE peacock is kept like the swan, for beauty more than use; some make it turn to account for the table, but 'tis not a common marketable provision; and nothing is worth the farmer's regard, that he cannot regularly take to sale.

'Tis hardly worth his while to let it take up the room of some

some fowl that might answer his purpose: for the sake however of those who shall chuse to raise them for their beauty, we shall lay down some short observations on their nature and qualities.

The peacock is the stateliest and most beautiful of the feather'd kind. It is very tender while young, but afterwards hardy enough; and as it requires little care, and finds itself in food, it may sometimes be worth while where there may be a demand for the chick, to allow one peacock and peahen to run among the poultry.

The peacock is kept without expence, and he is useful to the owner in his feeding. He rids the ground of vermin, for his feed is efts, toads and snakes. He will eat corn when he can get it, but the other is his common diet.

The peahen will make her nest in thickets and bushes; and she takes great care to hide it from the cock, for he will destroy the eggs.

When the peahen has set herself, it will be proper to put some corn and water near her, that she may not be under a necessity of leaving her eggs to chill, while she is seeking at a distance for food.

The time of her setting is thirty days, and as the chicks are tender when first hatch'd, they must be hous'd for some time, the cold otherwise soon killing them. During this time they are to be fed with fresh cheese, or barley-meal and water. They must be let out in the middle of the day, and taken in at night, and when they have got some strength and bigness, they may be trusted out with the dam, and no farther care need be taken of them. The cock seems not to own them till the feathers that form the coronet upon their head begins to rise; but after this he is as fond of them as the hen, and will call them about him to feed, providing for and defending them with great care.

From the time of their going at large, they need no more care of feeding or attendance, except any one has a mind to fatten them for the table. For this the usual time is when they have arrived at about half their growth: they are then put in a dark quiet place, and fed with any kind of corn as much as they will eat, and to have plenty of water. This will make them fat in a month, and their flesh will be better tasted than when they run at large, but they are inferior to almost any kind of fowl, and have a very strange, raw, bloody appearance, when they have been set by for a night after dressing.

C H A P. XL.

Of the pheasant.

THE pheasant, though naturally a wild bird of the woods, is much of the common poultry kind, and may be easily bred in the proper places. This is an article in the way of the gentleman rather than the farmer, therefore we shall not detain our industrious reader with any long discourse on the subject.

There are pheasantries in many parts of England, but there requires a great deal of care about the birds when young; and they are in danger from kites, hawks, and other birds of prey at all times. The pheasant is the favourite with these devourers.

The roosting places are to be well defended; and the fence is to be high to prevent their escape. They lay freely, and bring out large broods, and with good diligence, a number may be rear'd.

The food of the young pheasant is that white substance called the ants eggs. The old ones when wild lead them to ant hills in the woods for this, and they must be supplied with it by the industry of the keeper, when bred tame: this occasions a great deal of trouble at first, but after that they will be train'd up with great ease, for they will eat any kind of corn, and are not tender.

C H A P. XLI.

Of pigeons.

WE come to a fowl smaller than any of the before mention'd kinds, but superior to many of them in value. The management of this is different from that of the others, but there is no one of those about which so much care is generally taken, that is more worthy of the notice of the husbandman.

It will be kept at small expence: the proper pigeon for the dovecoat, which is the only kind he is to regard, the greatest part of the year provides for itself; and when it requires assistance, the food is not of a dear kind. Beside the breed, there is that great article their dung, which is of such great service as manure, that it must be the interest of every farmer to provide it for his own use.

There are many kinds of pigeons kept in England, by
people

people fond of curiosity, and it has become a study to procure and raise new varieties among those who are called pigeon-fanciers, but with this the industrious husbandman has nothing to do. He is to keep pigeons for their value, not their beauty; and he is to consider which may be managed with most ease, which is in his way one of the greatest of recommendations.

There are two principal sorts; the tame, and dovecoat pigeon. The tame is valued for his beauty, and for the largeness of its body; the common pigeon, kept in dovecoats, is smaller, and less beautiful.

The tame have but two young ones at a brood; but they make amends for the smallness of the number by the frequency of their hatching: if well fed and tended, they will have young ones every month.

In the choice of these the beauty is most regarded; but there should be care taken to pair them well, and this is the more worth while because they are not apt to separate afterwards.

They must be kept clean, and their food is so dear, that few but those who know very well how to manage them care to meddle with them. The best is tares or white pease, and they should have beside this some gravel scatter'd about; with clean water at all times; and a great deal of care must be taken to preserve them from vermin, and their eggs from the starlings and other birds, which always haunt the places where they are kept, to suck them.

To the perfect thriving of these pigeons, it will be proper, beside their food, gravel, and water, always to let there be some salt, clay, or some mixture with sea salt in it, for them to peck at their pleasure.

We have said thus much of the tame pigeon, for such as chuse to breed them; and although the expence and trouble they occasion be more than is worth the husbandman's while in general to give himself; yet their dung is richer than that of the common pigeon.

The common or dovecoat pigeon, is a subject that deserves the husbandman's utmost regard.

The keeping of pigeons is a great advantage obtained at a very small expence: they thrive best in open countries,

The husbandmen in some places sow great quantities of horse beans and grey pease, and in these pigeons feed to a great advantage. These sorts of pulse are sow'd earlier than other kinds: their early feeding upon them makes them

healthful, and is an occasion of their breeding earlier than they do elsewhere.

The common blue pigeon is properly the dovecoat breed; and it has the advantage of other kinds in that it is hardier, and will live in the worst winters.

If it be too small we may mend the breed by putting in a few tame pigeons of the most common kinds, and the least conspicuous in their colour: this is to be done with caution, for though the bigness of a pigeon's body is a plain advantage, yet the smallest are the best breeders.

The ringdove has been by some introduc'd into the dovecoat, by setting the eggs under a common pigeon; they will live, and take their chance among the pigeons: and they have two advantages, the one in their largeness, and the other in their hardiness.

The husbandman should have a careful eye upon the proportion of the sexes among his pigeons. There is nothing so hurtful as the having too many cocks. Most people who keep them make their consciences easy about deluding away those belonging to their neighbours; but an abundance of cocks thins the dovecoat, for they grow quarrellsome, and will beat others away.

A very cheap way of making a dovecoat is to build the walls with clay mix'd with straw: they may be made four foot or more in thickness, and while they are wet it is easy to cut the holes in them with a chissel.

This beside its cheapness, has the advantage of great warmth, and no building agrees better with pigeons. Such a dovecoat four yards square in the clear, may be built for five pounds.

The holes should be fourteen inches deep, and a little dipping backward. The reverend Mr. Lawrence who used this method, says, the pigeons prosper'd in it better than in any brick or stone building he had seen.

Of whatever materials it be erected, it should be white-wash'd frequently on the outside. The pigeon is a cleanly bird: and the white colour renders the building more conspicuous.

As to food, beside the pease and tares, barley is very proper; and buckwheat also is an excellent as well as cheap food.

For the greatest part of the year they take care of themselves. There are only two seasons at which it is necessary or proper to feed them. The depth of winter, and the middle or latter end of June.

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The reason of feeding them in the first of these seasons is obvious; the latter, is called benting time. There is a grass called bent grass, the seed of which is ripe about this season, and is the only food of that kind the pigeons can easily get. This is poor food, and pigeons at this season usually have many young broods; so that they will be starv'd if they are left to it. The farmer will always find his account in giving them food at this season, as well as at the other.

The breeder of tame pigeons gives them a lump of salted clay, and the same indulgence must be shewn to these. But as they are more numerous, there is to be a larger allowance. A large heap of clay should be laid near the dove-coat, and the brine of the family continually beaten in among it. Another way is to make a kind of mortar with lime, sand, clay and salt, which they will peck with great satisfaction: 'tis best to make it thin, and keep it so by often beating it up with brine.

In some places they lay what is called a salt cat, near the dovecoat. This is a large lump of salt made at the salt pans; and is the common method where there are works in the neighbourhood, but salt in a mixture with clay is better.

What I have found answer best is this. A heap of loam is to be laid near the dovecoat, and beat up to a kind of pap with brine: into this is to be thrown a large quantity of bay salt, and a little saltpeter, with a shovel full or two of large coarse sand. If the loam contain a great deal of sand, the less is to be added to it; where loam is not to be had clay will do, but a much larger quantity of sand must be put in. The best is large coarse sea sand, or that which is got in screening of gravel.

Salt is not only useful to please the pigeons, when in health, but nothing recovers them so readily from sickness. A mixture of bay salt and cummin seed is an universal remedy.

Many contrivances have been published for making the pigeons love their habitation. Some have advised the use of assafoetida, and other of cummin seed, but the best method is to keep up constantly a heap of salted loam: this they love, and they will stay where they can have it in plenty. This with the addition of keeping the dovecoat neat and clean, and not suffering them to be disturbed, will keep the stock in good number, and perhaps increase it at the expence of their neighbours.

The profit of pigeons is very certain; for they breed fast,

and there is a constant demand. Near great towns it may be worth while to keep some of the tame kind; because their young come early, and are so fat and fine, that they command a large price. But in the country the common pigeon is the proper kind; for though the price is not so great, their number, and small expence of keeping, make amends.

Among the methods recommended for drawing pigeons to a deserted dovecoat, one of the most ridiculous is that of a baked bitch. The creature is killed at the time she is proud, and then flead, baked, and laid in the dovecoat. Some improve upon the practice, by putting cummin seed in the belly: for the pigeon is really fond of the odd smell of this seed. This may have some effect; the other can have none. The plain account of this is, that a dovecoat has been deserted because of its dirt and nastyness; and they have cleaned it out, and laid the baked bitch in it. The effect of the cleaning they have laid to the carcass of the animal.

I have spoke often to farmers to recommend setting up of dovecoats; but have found it difficult to make them listen to me. While they have bought pigeons dung at a large price, and fetch'd it from a great distance, they have still been backward to think of keeping pigeons for their supply. There is a superstition among them, that it is unlucky to set up a new dovecoat: this has come from father to son, and they persuade themselves it would certainly be follow'd by death in the family. Nothing can be so ridiculous, or so weak, but there never was an old woman's tale so deeply rooted.

BOOK V. PART III.

Of FISH.

CHAP. XLII.

Of the advantages of fish ponds.

FISH are not considered so much as they ought, by the husbandman, as a part of his stock: but we shall endeavour to shew that it is as easy for him to manage these as any other of the already mentioned creatures, and that the profits are very well worth his attention.

He must have some water, and he may, according to the situation of his farm, have a great deal. Fish will live in
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this,

this, and he may have a reasonable profit in all cases, and in many a very large one.

One kind of fish will live in one water, another in another. There are some species that will live in all. He who has water, and leaves it unoccupied, defrauds himself of a part of his natural advantages.

It is not only his interest to put a stock of fish into ponds, when he has them; but it may be often worth his while to make ponds for this purpose.

We would put the farmer in a way of making the most from his land; and consider in what instances art may come in to the assistance of nature.

We shall here shew how he may stock the water, and how render that proper for fish, which was before unfit. And in what case it may be to his advantage to dig ponds for them.

There may be parts of his ground, which yield little any way else, and which may be converted to this use. He should put them to that use, though at some expence; and we shall lay down the most advantageous method of doing it. These lands are of two kinds; those which are naturally watery; and those which lie in the bottoms between rising grounds. The first kind are to be chose, because they are fit for little else, and the second, because they will answer the watering of cattle, as well as the breeding of fish. They will be supplied by the waters from the rising grounds, and will bring a great profit, as well as great convenience.

We write here to the gentleman as well as to the farmer; and we may name the supply of the table as a great article. All that is saved in the expence is got: and the addition of good fish in plenty is a consideration of great value. The farmer is to consider the demand at market; but this is abundantly enough to answer his purpose.

When the ground is fixed upon for making a fish pond, let the undertaker consider, whether there be springs to feed it, or it must depend on the rains: this makes a different management necessary. Ponds that have springs will be safe from drying on an entire flat: but there should be a descent to those which are to support themselves by rains.

When flags and rushes grow on a low piece of ground, 'tis a proof there is water near. The natural products of such lands are of little value: let the husbandman consider the expence and profit, this way or by culture, together with his own occasions for water, and the extent of the ground; and then determine what course to take,

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In those grounds which lie between hills, ponds will have the advantage of what is washed from rising grounds by rains. They will feed fish, water cattle; and afford from their bottoms a rich manure.

The water that runs in wet seasons from hills does not go off pure rain: it washes with it the lightest and richest parts of the soil, and the finest part of the manures the husbandman has laid on his grounds. This enriches the water, and feeds fish in a surprizing manner; and after all it is not lost. The making ponds in these places is the true way of saving it. All runs into them with the water: it settles to their bottom after a time; and is finally left there. This is the occasion that ponds situated so as to receive the water from high lands fill up soon, but that is no disadvantage; on the contrary, it is a lasting source of manure. These ponds are easily cleaned, and the mud many times over pays the expence of the work. It is proper provision should be made for receiving the fish during the cleaning of the pond.

The necessity of cleaning ponds is absolute, but so is the advantage. The time is different according to their situation. Those in an even ground, that are fed by springs, need not be scoured above once in fifteen years; but such as receive these rich waters from hills, require it every four or five years.

We have reminded the farmer of the great value of those creatures which are kept at little expence; this in the first expence is all. Many creatures are to be kept at a little charge; fish entail no expence upon their owner at all, for they will provide for themselves entirely.

It may be sometimes proper to throw into a pond where fish are feeding, some things of very little price, but even this is not necessary. Those of prey are to be supplied by first stocking the ponds with roach, and the like; which are of so little worth, that they are fit for nothing else, and are so numerous that they may be drawn up in a net by bushels: for the rest, grains, or refuse of the like kind, is all that can be given them.

C H A P. XLIII.

Of the making of fish ponds.

HE who would make considerable advantage from fish ponds, must have several: some to receive the fish, while others are cleaning; and some for one kind, and others

others for another. If he put his fish of prey and his others together, he would find a very sorry account.

Different ponds also are intended for different uses. Some are for breeding, and others for feeding of the fish. There should be a distinct pond for the perch, and another for the carp and tench; and there should be one pond for carp to breed, and another for them to feed in. In those ponds where carp breed, they feed poorly; and in those ponds where they feed well, they scarce breed at all.

Fish ponds are of two kinds, such as have sharp and clear water, and such as have it soft and thick. The first are for breeding, the others for feeding.

From what has been said of the number and variety of ponds, the farmer will the better conceive what is meant in those directions we are about to give for the digging of them.

The best method where the ground favours, is to have a row of ponds, with a small feeding spring at the upper end for the supply of the whole; so that in dry seasons they may be kept up with a due quantity of water. There should be also contrivances for letting off the useless or abundant water from them, that they may not be overflow'd.

At the end of every pond should be a sluice: this head must be made in the lower part of the ground. It must be firm and sound, and the sluice should be so made, that the water may be let off freely and quickly: the great care is, that there be a sufficient fall.

For making the head of the pond, a quantity of strong stakes are to be provided. They should be six foot long, strait, thick, and of timber that will bear dampness.

Let him set about his work by driving the stakes firmly into the ground in three rows, at four foot distance row from row, and about three foot severally in each row. These rows must be carried the whole length of the pond head: and the first row must be driven four foot into the ground.

This is a sufficient preparation for the superstructure, where the ground is tolerably firm; but in places where it is loose and sandy, it is a good method as soon as the stakes are rammed, to pour in a large quantity of lime. This will flake gradually with the wet, and mixing with the sand, will become of itself a firm mortar, binding all about the stakes in the manner of a stone.

When the soil is not absolutely sandy, and yet is not firm, it is a good way at first to put a layer of earth, and a layer of lime, and so work up the foundation.

When the stakes are driven, and the ground is secured, let the workmen begin to dig the pond.

Let the earth be thrown among the stakes, and rammed well down, and thus laid in till they are entirely covered.

Another parcel of stakes are then to be driven in the same manner as the first, and in the interstices between them, the earth that is dug is to be again laid; and so, if needful, a third parcel are to be driven, and filled up in the same manner with the earth that is dug out. The nature of the situation is to determine this, and the expence will be proportion'd to the making of this head in height.

This head is not to be raised perpendicular, and all of a thickness; but sloping upwards on each side. It must be thickest at the bottom, and smaller all the way up; and the slant on the inside must be made smooth and even.

The rest of the work is cheap and easy. The whole string of ponds are to be made in this manner, and they will be managed afterwards with ease and convenience. It will be a great addition to the work if a side ditch be dug, with sluices out of each pond to it, for the emptying them separately. By this contrivance any one of the ponds may be emptied without disturbing the others,

The size of the ponds, that must be proportioned to the nature of the ground or the quantity of fish.

The depth is a material article: for there are great inconveniences attending the making it too deep or too shallow. One reason of the ill success of fish ponds in some places is, that the owners have taken them just as they found them. A clay pit, or a gravel pit, may be converted into a fish pond; but he would be very idle who should take either for that purpose just as he finds it.

The proper depth is six foot. It may be something deeper, but no pond should be of a less depth than this, at middling fullness.

The ponds are to be some for breeding, and others for feeding of the fish; the poorest water being for breeding, and that which is most enriched by additions, for feeding.

Supposing these ponds to be all supplied by one original spring rising above the first; running through that, and thence into the others; the water spring will be clearer, sharper, and purer in the first pond, than in those others into which it runs through that, and successively through one or more of them also. In such a string of ponds, the first will be fittest for breeding, and the last fittest of all for feeding;

ing; and so of the rest proportionally, those will be fittest for breeding which are nearest the first, and those for feeding which are nearest the lowest. There must be a difference in the construction of the ponds, according to these purposes.

One breeding pond is enough to supply several for feeding: so that the proper method will be to keep the first for breeding, and the several others that come next after it, for the pike, perch, and other fish of prey; and only the two or three last for feeding: these will receive their water enriched by what it has collected in passing through the others.

The first pond should be the shallowest of all: and should have some places particularly shallow, and contrived for the receiving the spawn. Its general depth may be five foot; just at the head it may be, for a little way, five and a half, or six foot: the head itself should be carried down with a gentle descent into that depth, and toward the water's edge bottom'd with a clean gravel. The sides should also, in most places, go down with a gradual descent, and here and there be extended in shoals; some of which should have stones and gravel thrown over the bottom, and the others left naturally. These serve for the fish to sun themselves; and they lay the spawn upon them, which there receives the influence of the sun, and is assisted by it in the hatching into life.

Ponds that have a clean water, and a gravelly or sandy bottom, are best for breeding; those which have a soft or muddy bottom for feeding.

The middle ponds, should be of a somewhat greater depth than the others, that the pike, which grow large, may have a sufficient scope of water: but it will be convenient in these to let the head descend gradually, and to have shallows purposely left in some places, as in the breeding ponds. These fish will not only breed there themselves, but their food the roach, and other such should be encouraged to breed also. This they will do on these shallows purposely left, and in this manner such a supply will be raised, that the pike and perch will find their food naturally provided.

Those ponds intended for feeding carp, and such other fish, which are to be at the lower part of the row, should have the common depth of six foot, in a manner throughout; but it will be proper to leave here and there a little island standing in these; and in other places to hollow away the banks underneath, and to plant willows, and other watery

very trees, that their roots may bulge out into the water. All these will serve to give shelter and hiding places to the fish. These contrivances are proper also for the middle ponds in which fish of prey are kept: in the breeding ponds they are least needed. Though in moderation, shade and shelter are convenient every where. It is a good practice to sink some small faggots in different parts of the pond, when new dug: they will serve the purpose of sheltering, till weeds rise.

If too many trees be planted on the banks, they do a great deal of harm by the falling of their leaves; and too many, or too large islands left in the ponds, take up too much room; moderation is the rule.

CHAP. XLIV.

Of the stocking of fish ponds.

THE husbandman who makes ponds for profit, must form them according to the several purposes they are to answer. We will suppose he has eight of them in this spring, and has contrived the first for breeding of carp and tench, the second for breeding perch, the two last for feeding his carp and tench, and the four middle ones for feeding his pike and perch.

The four kinds of fish already named are the principal that he is to regard. Trout will not thrive in standing waters.

Eels are worth keeping in ponds, but there need not be any kept on purpose for them. They are a fish of prey like the pike and perch, and they may be kept in the same pond with either, they will thrive upon the small fry that are kept for the support of the others. They will grow to a great size in these ponds, but they are not like the eel of the river for taste. The finest eels are those caught in clear and shallow trout rivers.

Some put their pike and perch into the same ponds, imagining that the perch will escape the jaws of the pike. Where there is plenty of other food pike will let the perch escape, but when hunger calls he is not nice in distinctions.

Some keep chubs, bream, flounders, and the like in ponds, but they answer no useful purpose. The price they will bring at market is nothing in comparison of the others. A bream is not good for any thing till very large, and it will not grow to this under fifteen or twenty years, and requires

quires deep water. When it is at its perfection few know that it is good; and 'tis not the pleasant but the fashionable dish, that brings money. If gudgeons be kept it must be in the first pond, but they come to little there; they naturally live in swift shallow rivers: in ponds they lose their colour and their flavour.

These considerations fix the husbandman to the five kinds already named.

The first pond is to be set apart for the breeding of carp and tench, which may breed together as well as live together afterwards; for they will neither hurt one another when grown, nor devour each other's spawn.

Carp is the most profitable fish, and we shall begin with considering them, and deliver what relates to them most particularly. No fish bears a better price: and none spawns so frequently. When we add to this, that the carp is of quick growth, we have comprised all that can be said in praise of a fish to him who keeps it for his advantage.

Carp will breed at shorter intervals than any other fish, and the young are vastly numerous; they require little care, and are sufficiently hardy. The great caution is to provide and keep up a sufficient number of breeders.

The female carp never breeds till about eight years old. The male need not be more than five years. The purchaser must examine their size and condition, before he puts them into his breeding pond, that he may not be disappointed. Many have condemned the nature of their pond, when the fault has been in the condition of the fish.

The males should be about one to three females; and not only a proper number must be put in at first, but a watchful eye kept that they do not decrease without supplies, for the carp often dies after spawning.

The tench agrees in all these respects with the carp; and being put into the pond with the same regulations, the two kinds will breed together.

Into the second pond are to be put the perch for the same purpose, and with the same cautions. They will breed when they are kept in the other ponds, but they are so ravenous they eat their own offspring. And the only good way is to put them into those ponds nearly of the same size.

Pike will sometimes breed in the ponds where they are kept for feeding, but more in large rivers. Perch will also breed in their ponds, but few of the young come to any thing, for both kinds feed upon their own. The putting
fish

fish nearly of a size into the feeding ponds, is as necessary with respect of the pike as the perch, for they will both devour such of their own species as are smaller. A perch of half a pound weight will seize one of a quarter of a pound; and the pike will lay hold of such as are very nearly as large as himself; he will prey upon any thing that he can get into his mouth.

These are reasons why fish of prey that are put into ponds to feed, should be nearly of a size: and there is some cause, for observing the same rule with the others, for though they will not eat the smaller, they will starve them.

The best way of matching the size of the fish is by supplying the feeding ponds from the breeding: for those that are of the same breed, must be equal in bigness, and being put into the same place, and having the same food, they will keep up that equality. Pike are generally purchased, and the care should be to buy them nearly of a size, otherwise the number will decrease continually. When perch are bought, the same caution is to be observed. As to eels, they need not be so carefully pick'd, for they are defended from the other devourers by their place of habitation; and though they seize upon any other fish they can get at, they do not prey on one another.

The farmers must not suffer his geese or ducks, with their young brood, to come upon his pike ponds; for that voracious fish will seize the young, while they are in the down, as readily as he would a roach or a gudgeon.

When the ponds are stock'd, the owner should take care that herons do not get a habit of coming there, and he must be particularly guarded against otters, if there be any in the neighbourhood. These are the enemies of his feeding ponds; and there is one little regarded, but very destructive in those for breeding, this is the stibbleback. As contemptible an enemy as this may seem, none is so destructive of the spawn and the young brood; and none so difficult to be conquer'd. I have known many ponds that would have been excellent for breeding, spoiled by this little creature. The emptying them is hardly a security; for these small fish will live in the least quantity of water that remains in any accidental hollow, and they breed so quick, and in such numbers, that they soon are in a condition to renew their mischief. They lodge under the stones where the carp spawn. They devour the spawn wherever they find it, and what escapes and hatches into life, becomes their prey in that condition,

tion, for they are eternally catching the young fishes.

There has been supposed a great mystery in breeding ponds; some will and some will not do for that purpose, and it is said there is no knowing but from tryal. We have named the wrong age of the fish, for one reason of failing; another is this destructive creature; and a third may be the ill constructing of the pond. Let these three articles be managed rightly, and the undertaker will seldom fail.

The numbers kept in the feeding ponds, must be proportioned to their extent, and to their richness. A good feeding pond, of an acre, will every year support two hundred carps, of three years old. If they be put in younger the number is to be encreased in proportion, the same pond will as well feed three hundred carp of two years old, or four hundred of one year old. If the pond be less rich, the number must be smaller, and if of the richest kind of all, it may be somewhat encreased.

Tench may be put in after the same manner: it is a good method to put in one third part of the number tench.

The nature of the pond as to its suiting one or the other kind, depends on the soil. The carp loves a loamy bottom, and the tench a muddy one. The carp loves a new pond, and the tench an old one. The carp is found to thrive best where there are a great many weeds, and good shelter, and where there grows long grass about the edges of the water: the tench loves a deep pond, with a warm owzy soil and hollow banks; and delights in the clusters of flaggs that often run into the water to a good distance from the shore.

From this the owner will conduct himself according to the particular nature and condition of his ponds. If they be nearly alike, let him put tench and carp together into each, and proportion them according to the nature of the pond, adding to or diminishing the number of the tench, as it appears to be more or less suited to them. If one of the ponds be well suited to carp, and the other to tench, let him put all his carp into the one, and all his tench into the other.

Tho' tench and carp be fresh water fish, they will thrive where it is a little brackish. This is of great consequence to farmers situated toward the sea. They often have grounds of no great use where fish ponds may be dug and supplied, but that the water will not be perfectly fresh: they need not for this reason be disheartened from breeding carp and tench: they will succeed as well there as in the most perfect

fresh ponds. Where the water is too salt, they do not taste so well as in the fresh water feeding; but where it is only a little brackish, they thrive better; and the difference is not perceived.

C H A P. XLV.

Of feeding, preserving, and taking fish out of ponds.

THE fish being put into the ponds are to be provided with food, preserved from injuries, and at proper seasons taken out for the market.

As to feeding, that requires little care or charge. The pike and perch are to be furnished with a quantity of roach, dace, gudgeons, and the like, the common draught of every little river; but he must have his eye upon them, that if they do not breed, he must at times throw in a fresh supply. As to the carp and tench ponds, they in a great measure supply the fish themselves by the richness of their water, and by the insects and small animals that breed in them: but if at times he throws in grains, blood, and the offal of chickens, their guts and the like, the fish will feed the faster. The same may be thrown into the breeding ponds; the grains into the carp and tench ponds, and the offal into the perch.

This is all that is required on the article of feeding. Care must be taken to keep off thieves, especially near great towns, where there is a ready market: the keeping a good watch, and the sinking things in the ponds in a proper manner to prevent the drawing of them, are the great security.

There is another accident to be named by which numbers of fish are often destroyed, that is the frost.

When water is altogether covered with ice, the fish languish, and if this continue a long time many die. Many break the ice, and this always has a good effect. The damage done by frost is much greater in foul ponds than in clean. For this reason the ponds should be frequently cleaned, which is an article of advantage to the farmer rather than expence, because of the value of their mud. When they are kept clean, the frost will have less effect upon the fish; and to prevent the damage entirely, there should be a few pipes laid into the water in different places, with their ends above its surface. Let the frost be ever so severe, these will always keep a communication with the air.

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Some lay in straw, but its effect is not so certain: that of a few pipes is obvious, and cannot fail.

The frequent cleaning of ponds, is also serviceable to the fish.

For the taking the fish out of the ponds, there require a few instructions.

In the common way with nets, a great deal of mischief is done by servants, hurting those which are to be thrown in again, by blows; and keeping them too long out of the water: and in the other way of draining, a great disturbance is made by letting the water of one pond into another. Against this we have proposed a method, by a ditch cut along the side of the ponds, which every one who deals largely in fish will find vastly worth his while to practise.

Once in three years every pond should be drained, and the fish taken out and sorted, removing the larger and smaller than ordinary, to keep up that equality, which we have shewn to be so essential an article in the management of every kind.

The breeding ponds are to be drained as well as the others; and from them are to be taken the young fish of proper size for the supply of the feeding ponds, in answer to the quantity that have been taken out. And when this is done, the remainder are not to be thrown into the breeding pond again, for they will starve the breeders: they must be put somewhere to take their chance, if they be not wanted on any particular occasion.

Great care must be taken not to hurt the breeders, either by violence, or by keeping them too long out of the water; and if the due numbers be found deficient, they must be supplied with those of a proper age and condition.

Thus the whole string of ponds will be kept in order, and yield great advantage: there will be a constant supply from the one to the other; and the fish will answer as regularly the farmer's expectations, as any part of his stock.

When any fish are taken out for sale, the master's eye should be over the draught: it will keep in his mind the condition of the stock, and he will see that no hurt is done to such as are to be put in again.

If the farmer have convenience of digging a pond where it will have a marley bottom, he may be sure of feeding carp to very great advantage. If he have opportunity of making a pond where it shall receive the washings of sinks, or the foulness of great houses, or about large towns, he may be

sure in the same manner both carp and tench will fatten in a surprizing manner. If he can make a pond at the head of a chalky spring, he may feed trout in it, and this is the only pond that can at all suit that fish: but even here they will not succeed as in rivers. If the pond be dug in a bed of clay, or if he clay it to make it hold water, and it be found too cold for the better fish, he may breed flounders in it. They will take care of themselves, and will grow to a great size; they thrive in such ponds better than in rivers, but their taste is not so fine.

When ponds are made in boggy places, where carts cannot well come to get away the mud, the best method is to dig them long and narrow, like ditches, that the workmen may be able to throw out the mud on either side at a single tofs.

The pike grows fast, and is well worth keeping in feeding ponds: those of six inches long may be had for a small price near large rivers, and if put into ponds with plenty of food, they will grow to fourteen inches the first year, and the next to two or three and twenty. To fatten them they should have eels chopped to pieces: they will devour these greedily. When pike grows to a good size, it bears a large price, but the constant and marketable fish is the carp. On this the person who intends to make advantage of fish ponds, should principally rely: none require so little trouble, or is liable to so few accidents.

None is so safe from the common accidents as the carp. It will endure frost better than any; it is so shy, that it preserves itself from common enemies. No fish is more difficult to be taken out by the common methods of stealing. They will not readily bite at the hook when grown to a size, in rich ponds; and even the casting net rarely surprizes them. They plunge to the bottom upon the first notice of any disturbance in the water, and strike their heads into the mud. The net draws over their tails, without laying hold of them.

BOOK V. PART IV.

Of BEES.

C H A P. XLVI.

Of bees, their nature and products.

THE bee is kept with little expence, and less trouble ; and it yields him two commodities that are always marketable, wax and honey.

Volumes have been written on this insect before its nature was well understood, and volumes therefore might be added : for with the more perfect knowledge of its nature, we have arrived at the discovery of many of its qualities ; but we do not here expatiate for the sake of idle curiosity. It is the interest of the husbandman to keep bees, for they will bring profit, and naturally fall in the way of his profession ; this we recommend to him : and that he may do it in the most advantageous manner, we shall lay down the best rules for that purpose. As we have endeavoured hitherto to explain every article of his business, that he might always know what he ought to do, and why he was to do it ; we shall lay before him here in a few plain words, an account of this creature, so far as he needs to know it, with the nature of those products which it offers to his service.

The antients supposed bees produced from the corrupted flesh of animals, and pretended to lay down methods of procuring them : but all this is known to be an error. Virgil advises killing bull calf, and exposing its flesh in a particular manner for the breeding of bees : but there is no more truth in this than in Sir Kenelm Digby's receipt to make crawfish.

All creatures are produced from the eggs or embryo's of their parents, and they can be produced in no other manner.

In insects, all such as have no wings, are produced from the eggs of their parents, in their own forms, but all those which have wings undergo a kind of change. These are hatch'd from the eggs of their winged parents, in form of caterpillars, worms, or maggots. Thus they live a certain time, and then fall into a state of rest, covering themselves with a web of their own making ; or shrinking into their skins which harden for that purpose : and after they have lain a certain time thus, they break forth in the winged form like their parents.

This has been supposed more wonderful than it is ; the vulgar have thought that it was a change of one creature into another ; and the learned adopted the folly, under the hard word metamorphosis. But the truth is, the butterfly is in the caterpillar, and only takes that time to grow to its due perfection.

The bee being of the winged kind, must have its origin in the same manner. When the combs are made, a female parent lays an egg in every cell, the eggs hatch into a white maggot ; and after these have lived their time, they fall into a state of rest within the cell, and in due season the bee bursts forth, and takes its flight.

Bees are of three kinds : in the generality of animals there is a male and female sex, and no other difference ; but among bees, there are males, females, and others of no sex.

These last are the greater number, and go through all the drudgery. The males are but a moderate proportion, and when they have performed their office in impregnating the females, they are driven out of the hives to perish. The females are very few, but each lays a vast number of eggs. They are distinguished from the others by their size and shape, and have been called by the names of kings and queens of the swarm.

Wax and honey are extracted from the flowers of plants. The wax is somewhat altered by the creature to bring it to that state, but the honey they find in its own form.

In the flowers of plants there stand up certain slender threads, with little lumps upon their tops. These are in some more, in others fewer, and upon the number of them is founded the present fashionable method of botany. These knobs in the centre of flowers, contain a fine dust, which serves to impregnate the seeds of the plant : but as nature frequently provides for many purposes in the same thing, this powder is formed in a greater quantity than it is wanted for the service of the herb, and assists the bee for its combs, in which to deposit the honey and its young ; furnishing the materials of which wax is fabricated by the creature.

Toward the bottoms of some flowers, and at the bottoms of others, there are also certain cells, or lodgments of different kinds, in the which is held a sweet juice : this is honey. The bee takes it out, and has nothing more to do than to carry it to its cells.

This is the origin of wax and honey. The bee feeds upon

on the dust in these lumps in the centre of flowers, and afterwards disgorges it for the service of the hive. It affords some nourishment to the little body of the insect, and after that is carried off, and the residue has undergone the operation of the stomach, it is wax. With this the combs are formed of that beautiful and useful figure, and in the cells of these is deposited the sweet juice, which they collect from the bottoms of flowers, and which, without any assistance from them, is honey.

Thus much it is fit the farmer should know; for the rest it is matter of curiosity, and a great deal might be said very prettily, but very uselessly with respect to him on the several subjects.

C H A P. XLVII.

Of hives, and the manner of placing them.

THE bee joins its fellows, which collect together into a swarm, and make of the wax they prepare from the dust of flowers, their combs. In which they deposit the honey.

They naturally place these combs in the hollow of a tree, but in order to make the most of their products, men have contrived places of reception for their combs, into which they tempt the bees to come. These are hives, which in different places, and at various times, have been contrived of several forms and materials: but the useful kind at present are made of twisted straw, and none are better. A great many sorts have been devised for pleasure, and the curiosity of seeing the bees work; but for use none answers better than this, nor is any other worth the husbandman's regard.

There have been contrivances to save bees when the honey is taken; but these are not necessary. A proper management with the common hives, placing one over another for the reception of the creatures, will answer all the same purposes.

Straw hives are often made too high for their width. The best size is such as would hold six gallons, they should be made a little more squat than the common practice.

There should be some of a smaller size for receiving the little swarms; and a few larger, that they may be in readiness for an extraordinary large one.

The hives must be trimmed smooth and even, and the

spleets are to be then put in, three or four descending from the top to near the edge, a couple of others to support the opening or door, and two more behind: these last are to be thrust firmly into the substance of the hive, to keep it from sinking when full.

The next care is finding a fit place for setting them: the bee is tender, and the whole work will proceed the better, for a little care in the setting out.

Let the place be chosen not far from the house, and defended from winds every way by proper hedges; but these should not keep out the sun; for the bee requires warmth, as well as stillness. The spot must be well defended against cattle, the best situation is when the house stands to the north, and the opening is to the south. There should be also some trees pretty near to receive the bees at the times of their swarming.

Let there be set a parcel of stools for the hives: the usual method is to set several together on a bench, but it is not so well. It occasions confusion among the bees, who mistake one hive for another, and in winter they will quarrel, and do one another a great deal of mischief.

The stools should be only of wood, for those covered with stone are too hot in summer, and too cold in winter. They should be raised about a foot, or a little more from the ground, and placed a little slanting, that the water may run off. On the top they should be about an inch broader than the bottom of the hive; and in front just before its door, they should have an extent of the bigness of one's hand for the bees to settle upon when they come home loaded. These stools should be set in a row from west to east, and they should face the south, a little inclining to the west, that the body of the hive may break the east wind from the door.

They may be inclosed in a little boarded building, singly, or several of them together; with a tiled covering to keep off wet, and doors to shut or open according to the severity or mildness of the season.

This is not of absolute necessity, for people keep bees to great advantage without such trouble; but the expence is little; and those things which will of themselves succeed very well, yet often bring larger profits in proportion to the care bestowed upon them. The two greatest hurts to bees are cold and wet; and the latter is the greater.

In

In winter bees are most liable to injuries; but these they in a great measure escape if their hives be well made, and well defended. A building about the hives darkens as well as shelters them; and this in winter is of great service, for it prevents their going out at every time when the sun happens to shine: this they otherwise are too apt to do, and are often killed by the cold while abroad.

For this reason the greatest number of bees perish in the mildest winters. They keep within the hives in very severe seasons, and are safe, whereas they go out in mild days and perish.

When bees are kept dusky and sheltered during winter, the doors are to be thrown open early in spring, to promote their industry and their breeding.

At the time of swarming, the hives are to be rub'd with thyme, hyssop, or bean tops, and it is a good method to rub a little honey on the inside.

The hives are to be plaistered down to the stools with cow dung, sand, and a little lime, this must be carried round the edges to keep all close, and fence out the wind; and in the winter the door of the hive should be stopped with a small piece of board that has two or three notches in it to let the bees through, and not large enough to let in any thing that would hurt them.

C H A P. XLVIII.

Of the swarming of bees.

WHEN bees encrease, they naturally swarm. The time of this is the beginning of summer; and it is a season at which the owner is to watch them with a particular care. The encrease of his stock and his profit depends principally upon his management at this juncture.

The fullness of the hive is the reason of their swarming. They sometimes get a way of lying out of the hive, under the stool or behind; and in this case, not perceiving the hive to be full, they will not swarm.

The swarming depends on many accidents, and none more affect it than the weather. In a mild spring they swarm early: in a cold and backward season they do not swarm well; and what they do is later.

Toward the middle of May, the owner is to watch the hives. When the drones are thrown out early, it is a sign the hive is full; and when the bees after this are seen in clusters

clusters about the door, and often lie out; and when there is some moisture about the foot of the hive, at times, and they hover in great numbers together round the door, it is a sign of swarming. When there happens a warm gleam of sun, after a slight shower in the middle of a calm day, they may be expected to rise; and if just after this they be seen hanging in clusters about the door of the hive, it is to be immediately expected.

If the weather prove stormy when the bees are ready to swarm, it will prevent them; and if this happen from time to time, they will put it off entirely, and the opportunity will be lost for that season. Sometimes in extremely hot and dry weather, they will lie so continually out, and so many of them together, that not perceiving the fullness of the hive, that also will prevent them from swarming.

As their own sense of the fullness of the hive is the great reason, the owner should force them in to it, in good swarming weather. He should also shade and cool the hive at these times, if the weather be very hot. If those which hang about the stool be gently moved off with a brush, it will cause them to rise, and the noise of several of them flying up together, will sometimes call out the others, and make them swarm.

When bees lie out in great numbers raise up the hive, and let them all in, and then fasten down the sides with cow dung and sand, leaving only the door open. This will make them perceive the fullness, and they will be led to swarm.

The good women have many idle customs for making bees swarm: but these are founded upon reason.

One swarm not sufficiently unloading the hive, at eight or ten days distance, there will be another ready. These are what they call after-swarms, and the owners know of their coming out by the noise. They call one another with a sharp and shrill note, and presently rise in numbers.

When the first swarm happens to be broken, the second will sometimes come the next day, and after this there will come a third, and sometimes a fourth: but all this happens within fourteen or fifteen days.

The country people are superstitious about bees, but we wish to break through those idle customs. As soon as the swarm is risen, they ring upon a kettle or pan; they imagine this brings them down, but nothing is more contrary to reason. Their swarming is an operation in the course of their nature, and they should be left quiet while they are

about it: all noise disturbs them; if there be danger of their wandering, a little dust is to be thrown among them, and it never fails to quiet and bring them down.

The beating upon kettles was invented as a signal to the neighbours, that such a one's swarm was up; they did not know that it was of ill consequence, and they have been followed in it by those who have imagined it to be useful.

Sometimes a new swarm of bees will cast another the same year; of this the husbandman cannot be soon aware, but he is to watch as soon as he sees the first signs of it, and follow them in all respects as the former swarms.

When the swarm parts, he is to act according to the distance at which the two bodies settle.

If they be within sight, the best way is to disturb the lesser cluster, and they will rise and go to the greater: if they be out of sight they must be hived separately.

C H A P. XLIX.

Of the hiving of bees.

THE hives being ready, he is to get the bees into them in the following manner. They soon cluster together, and when they are clung one to another, and well settled, they are to be got into the hive.

According to the bigness of the swarm he is to chuse a larger or smaller hive. The bees will bear some disturbance without resentment, but they must not be too far ruffled; when they are angry their sting is a severe weapon. It may always happen that some may be provoked in this great article of hiving, and for that reason the person who undertakes it should be prepared against the danger. Let him have a net wove, with the meshes so small that the bee cannot get through them, and large enough to be put on over his hat, and fall down upon his shoulders. His face and neck will be thus perfectly defended, and he will be able to see what he is doing: let him put on a thick pair of woollen stockings, and gloves of the same stuff, drawn pretty high upon his arm. Then let him go to work sedately and softly, for any hasty motion disturbs and angers the bees.

Let a cloth be spread upon the ground near where the bees are settled, and the hive laid upon it. Their common place of alighting is the bough of a tree, and if this be a small one let the husbandman gently cut it off; let him take it down quietly and lay it upon the cloth, and set
the

the hive over it. This is the most familiar way, and none succeeds so well. When the bees have settled upon a larger bough, or otherwise disposed themselves, so that this method cannot be taken, the husbandman is to shake them off into the hive, and then to set it upon the cloth spread for that purpose. If they light near the ground, the best way is to draw the cloth under them, and then shaking them off, to cover them with the hive. When any number gather at some distance from the hive, he is to move them gently toward it with a brush; and if they take to any other place, he is to wipe them off with the brush, and rub the place with wormwood; finally, the swarm is to be set as near as can be to the lighting place, and all left to be quiet.

Sometimes the swarms come late, and are small; so that the best of them not sufficient to fill the least hive, the husbandman is then to put two or three of them together in one hive; for otherwise they will be poor, and liable to accidents, and will rarely come to any thing. If two or three follow one another, though not on the same day, let him take them one after another into the same hive, and by thus joining them, and forming a tolerable body, they will become industrious and defend themselves, which singly they would not do.

The method of joining them is this. Near the stool spread a cloth upon the ground in a calm evening, when it grows dark; then set two supporters for the hive, and knock down the hive out of which the bees are intended to be removed. Lift it up, and clap it between the hands, to get out the bees that stick to its sides: then lay it down on one side by the bees: and over them set the swarm to which they are to be added, placing their hive upon the supporters. They will naturally rise into the hive, where they will join the bees that are in it; and if any remain about the empty one, it is only disturbing them, and they will follow the rest. In this manner another swarm may be added to them, and one hive may be thus well filled with those which would have succeeded very badly in two or three. When the bees are all got in, let the empty hive be taken away, and the full one placed upon a stool that night, or early the next morning.

There is another easy method of uniting two swarms, or more, which is this. Let the hive into which a small swarm has been taken, be turned bottom upwards, and

in that manner fixed to the bottom of the other hive with its swarm, fastening up the joining of the two. The bees of that which is undermost will fly up into the other, and then the lower one may be taken away. In this manner a second or third small swarm may be added to the first, till it be encreased to a proper quantity. But this must be done before the bees have begun to make combs; for when they have once set to their work they are unwilling to quit it.

As soon as they are settled in the hive they get to work, and in a very few days form large and compleat combs.

When an old stock of bees are to be removed, a proper season, and a proper day are to be chosen for that purpose. The beginning of October is the best time, but it may be done in February. Fair and still weather should be chosen for it; and an evening is the best time, when the bees are quiet.

C H A P. L.

Of the preserving of bees.

BEES, for the greatest part of the year, provide for themselves; but in hard seasons they should be assisted. They will repay the owner's trouble with interest.

One article that makes this the less expensive is, that the number of bees at the time when this is wanted, is not nearly equal to what it is at other seasons of the year. 'Tis only in winter they require assistance, and they are by that time greatly decreased by deaths, since their swarming. A great many die in autumn, and many more as the weather grows severe.

It is often proper to feed them also in spring. When the stock of honey is small at this season, nothing is better worth while than to feed them, and the best way is by conveying the food in a cane, or little trough, into the hive. The best food is a mixture of honey with sweet wort, or new beer, and a little bay salt: this gives them the needful supply of nourishment, and makes them healthy and vigorous. Some give bread sopped in ale, and they will eat it greedily: but the honey is the best, because it is the most natural food.

The season of spring feeding is in March. They begin then to breed, and if they have had a bad season, and want food, they will not attend as they ought, to the producing their

their young, which is the most important of all considerations to him who wants to increase his stock.

Bees that want food in the winter often do not deserve it. But these always repay the trouble largely.

We have shewn what methods are to be used for the keeping bees alive at all times, and making the most of their lesser swarms; but we are yet to remind our farmer of guarding them against such things as are offensive; and preserving them from what would destroy them.

All noise and disturbance are to be as much as possible kept from them. Cattle should be kept away by good fences, and the place of setting them should be far from publick roads.

Smoke is very destructive of them, especially that which rises from the burning any thing upon the ground: this is easily driven by the least wind just upon them, being on their level. All bad smells also do them harm, and render their habitation disagreeable.

They must not be exposed to their enemies, field mice will destroy them, and birds of many kinds will devour them.

In years wherein wasps and hornets are numerous, they also do great mischief, entering the hives, and plundering them of the honey: to guard against these, set vials of sweetened cyder near the hive, nothing tempts the hornet and the wasp so much.

Bees are often very troublesome, and destructive to one another, by fighting. To stop this, close up the hive: but if matters be too far gone to admit this remedy, the sprinkling a little dust among them answers the purpose.

C H A P. LI.

Of taking the honey and wax.

THE husbandman keeps bees for honey and their wax. And we now come to making his advantage of those products.

Of wax they make their combs, and in the cells of those combs they lay their honey. The wax not being eaten would remain uninjured in the hive during winter; but this is not the case with the honey. It is the store they lay up in summer for that season; and the way of obtaining it in the largest quantity, is to find the time when the combs are fullest.

All

All summer they are collecting honey: in August the combs are fullest; and from that time the bees often eat more than they get. The end of August is therefore the proper season for taking out the honey.

The old way is to kill the bees, and take their produce at this season: but many methods have been invented for saving them. There is not any great purpose answered by preserving them when their food is taken away, unless more care and trouble be taken about them, than the farmer can bestow: we shall advise him to follow the old method, and destroy the swarm when he has taken their stores. This practice is not so cruel as it appears, for the life of the bee is very short naturally; and with the best management they pass but an uncomfortable winter after they are robbed of their provision.

At the end of August let the husbandman consider what he will keep, and what he will kill. He is to be directed by the age of the swarms: the best to keep being those of one or two years standing; or those of three or four years, which, by reason of their not swarming the last summer are full of bees, and are the most likely to be good. The swarms of three or four years old which have cast hives are to be killed, because they are not like to continue; and poor swarms that are not worth feeding; and all light stocks, and such as do not carry out their filth, or drive away the drones in good time. These are the principal rules he should take for killing all such as are three years old or upwards, that have missed swarming the two preceeding years, and such as are weak and easily plundered. He is not to omit a large store, whatever be the condition of the hive: if he perceive any to be very full, as they will sometimes in good years be down to the bottom, he must take these: they never can be better, and often one such hive is worth three.

When these hives are marked, let a hole be dug in the ground nine inches deep, and nearly of the bigness of the bottom of the hive, and let the fine mould be piled up round the brim. Two hours before sun set, take a brimstone match as long and thick as a large skewer, fix it in the slit of a small cleft stick, with a sharp point. Stick this in the ground at the bottom of the hole, so that the top of the match may come within an inch of the level of the rim: if one be not thought sufficient, another may be added, prepared in the same manner. Let the top of each match be lighted, and then set the hive over the hole. Draw the fine mould about the

the edges to keep in the smoak, and thus let it stand a quarter of an hour. In that time the bees will be all dead.

The hive is then to be taken into the house, and the combs are to be carefully separated, taking them out one by one. The dead bees are to be brushed off with a feather, and the combs are to be broke each into three pieces.

A good deal of honey will flow naturally out of these, and this is to be kept by itself. It is called virgin honey: but the same name is given to the first honey of any swarm. Let this be put into a pot, and set by two or three days. In that time if there be any wax or other foulness among it, that will work to the top in a kind of skum, and is to be taken off.

When the combs will run no longer they are to be pressed, and this way they afford a large quantity of what is called common honey. After they have been thus pressed, they are to be washed, and when all the sweetness is out of them, they are to be worked for wax. The liquor in which they are washed, and the coarser part of the honey, are usually made into mead.

The combs are to be set over the fire in a large kettle of water, and boiled, stirring it continually about to prevent burning. When the wax is well melted, pour all into a strainer, and immediately put it into a press, setting a vessel of cold water under it; into this let the wax fall; and let the pressing be continued as long as any can be forc'd out.

When all is got that will come, let it be taken out of the water, and moulded and worked up into balls in the hand; and after this let these balls be broken to pieces, and set over a gentle fire to melt. Let the wax be skimmed as the froth rises, and then let it be strained slowly through a canvas bag, and received in an earthen pan, or other mould, which is to be first rub'd over with honey.

This is to be set to cool very gently in a warm room, and when thoroughly cold, and taken out, the bottom is to be pared off, and it is ready to be sold.

End of the FIFTH BOOK.

A c o m.

A
COMPLEAT BODY
OF
HUSBANDRY.

B O O K VI.

Of TILLAGE. IN SIX PARTS.

I. Of Plants, and their Nourishment.

CHAP.

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3. *Of the Manner of Roots receiving their Nourishment.*
4. *Of the Importance and Use of the Leaves of Plants.*
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17. *Of the Preparation of heathy Land for Corn.*
18. *Of the Preparation of Land for Corn after the artificial Grasses.*
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24. Of the several Kinds of Plows in common Use in England.
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27. Of the Wheel Plow.
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29. Of the Management of a Plow in working.
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39. Of the Drill Harrow.
40. Of Rolling.
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43. Of Sowing in general.
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45. The practical Method of finding the proper Depth for Seeds.
46. Of the Quantity of Seed to be sown in the common and drill Husbandry.
47. The Practice of different Places in respect of Quantity.
48. Of the Advantages the Drill Husbandry receives from the Hoe Plow.
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53. Of Drilling.
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55. Of

- 55. *Of the Benefits of deep Hoeing.*
- 56. *Of the different Appearance of Crops.*
- 57. *Of Drill Boxes.*
- 58. *Of the Wheat Drill and Turnip Drill.*
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VI. *Of the Benefits of Drill and Horsehoeing Husbandry.*

- 60. *Of raising Turnips by the Drill and Horsehoeing Husbandry.*
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- 66. *Of the Manner of Horsehoeing of Wheat.*
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THE INTRODUCTION.

Of improvements in husbandry, and the manner to undertake them.

WE now enter upon the greatest article of the farmer's business: a subject of the utmost importance to the publick, as well as to his private consideration; and tho' the most continually practised, the least understood of all.

We have endeavoured to acquaint the husbandman with the reasons of his several practice, and shall more particularly than any other occasion, attempt it here; because there is no part in which improvements are more wanted, nor any in which they may so easily be made.

There is but one way of rationally setting about these; this is by understanding as well as observing the practice of others, and applying what may be discovered from such reasonable experience, to farther parts of the subject.

It is by this method we shall endeavour to enlarge the knowledge of the farmer on the present head; that he may know in what manner to undertake what reason and the experience of others shall shew him to be practicable,

at the same time that it points out the certain utility and advantage.

We have instructed him in the preparing, planting and stocking his farm; he is prepared to enter upon the tillage of his land; and he is to consider by what method that may be undertaken to his best advantage.

The old practices of husbandry had their use, for every kind of tillage adds to the fertility of the ground; but in the course of an employment followed by so many persons, and for so long a period of time, improvements have been made. To adhere only to the old methods, were to shut the door against knowledge; and on the other hand to admit all that have been proposed among the new, were to perplex instead of informing ourselves by experience.

All sciences are imperfect at first, and by degrees they arrive at more perfection. The greatest advances are made by frequent practice. Among the many who follow husbandry, the greater part think no farther than to imitate the labours of their fathers: and of those who have had the spirit to pursue the subject farther, too great a part have been carried away by fancy; and have laboured rather to establish some new system, than to add to real knowledge. These are to be little regarded; but, too much respect cannot be shewn to those who have followed utility in their studies, and adhered to truth in the delivering their result to the publick. From these we are to hope for real improvements in the art; and we shall find in their writings the best foundation on which to build our reasonable attempts for the carrying agriculture to a greater perfection.

Among the writers who may be useful, there is not one who deserves greater praise than Mr. Tull, the author of the famous treatise on horsehoeing husbandry. This gentleman has not only been of service, but has done honour to his country, for the greatest respect has been shewn to his writings, by those who cultivate useful studies in every part of Europe. His method has a great deal of reason and utility; but there are faults as well as excellencies in the book, and while we give the due praise, we are to caution the reader against too close an adherence to all the propositions.

This author had a great deal of experience, and he directed his pursuits upon a new plan. He has furnished innumerable hints for improvements, and has carried many of them himself to a great degree of perfection: but he is too fond of the system he wrote to establish; and the useful discoveries

coveries with which his treatise abounds, are clouded by vague reasonings, and often buried in a tedious prolixity. These useful discoveries we intend to present to the reader, without his errors or his partiality; as they have been approved by those foreigners who have adopted the practice, and as they stand confirmed by experience.

To this ingenious writer we owe the establishment of horsehoeing husbandry practised in some parts of England at this time, and with great success in many other countries. In our observations on this head, we shall form the advice we give to the practical husbandman, not upon this or any one author alone, but upon the result of their several opinions, and of the experience of those who have brought their proposals to a trial.

Mr. Du Hamel in his treatise on cultivation, has adopted what was useful in Mr. Tull; adding what himself had farther discovered, and retrenching that author's errors: what he did by Mr. Tull we shall do by him. It is thus the writings of one author are made useful by the labours of another.

The horsehoeing husbandry owes its origin to a long neglected passage quoted by Mr. Evelyn. The most celebrated authors we find are not the most read. The passage is this, "Take some of the most barren earth you can find, powder it well, and expose it abroad for a year, stirring it about frequently: it will become so fertile as to receive and nourish a plant from the Indies, and will cause all herbs to prosper in the most exalted degree, and foreign ones to bear their fruit as kindly as in their natural climates."

If we add to this remarkable quotation the contrivance for sowing, invented by Lucatello, an Italian, and published in the sixtieth number of the philosophical transactions, which in the essential points agrees with that proposed by Mr. Tull; we shall find the foundation of horsehoeing husbandry has been long since laid; and shall wonder that what had been so plainly delivered in books, was not before brought to practice.

The use that has been made of these discoveries and inventions since, and the improvements that are now carrying on in many parts of Europe, by the practice of this husbandry, shew the great utility of books in proper hands: nor does the inventor or the writer deserve more praise, than the person who brings what they have devised into real practice.

In our consideration of tillage we shall explain this great improvement, taking that latest invented method first into consideration, as there will be opportunities of explaining the nature of culture more from it, than from any other; and as in order to enter into the advantage of any method of husbandry, there should be first convey'd some general knowledge of cultivation; we shall premise some observations on this interesting head. For the better understanding of these, we shall begin with explaining to the reader, who is not accustomed to these researches, the nature of the vegetables themselves.

To understand in what manner nourishment may be conveyed to the roots of plants, he should first be acquainted with the nature of those roots. For this reason we shall follow the method of those who have written most rationally on this subject, and premise some remarks upon the nature and texture of the several parts of plants as they regard the present enquiry: considering them only so far as their knowledge may be useful to the husbandman.

BOOK VI. PART I.

Of the Parts of Plants, and their Nourishment.

CHAP. I.

Of the roots of plants, their kinds and forms.

ROOTS may be divided into two kinds: those which spread under the surface of the ground, and those which penetrate strait down: the first of these we shall call spreading roots, and the other tap roots.

The roots which first shoot from the seed of a plant, are always of the perpendicular kind: they run strait down into the earth, till they find it too hard for their proceeding farther. Where the soil is soft and deep, these penetrate much farther than is imagined. They will reach many yards into the earth.

When these are cut, they change their nature, and each divides into many others. This is not easily seen in plants growing in the earth, because their roots cannot be taken up perfect; but experiments made on such as are raised in clear water shew it.

All tap roots push out certain fibres, which spread in an hori-

horizontal direction : and these are the more vigorous, the less they are buried in the earth. The most strong and serviceable spread always near the surface ; and within that depth of the soil which is stirred by the plow and other instruments of husbandry.

These are of the nature of those roots we call horizontal. Some plants have thus a main body which runs strait down, and fibres growing from it : others consist of these spreading fibres only, these run often to a very great distance from the plant ; but in this case they become so small, that they are hardly to be discovered, especially when they are of the colour of the earth among which they lie, as these small fibres commonly are.

A carrot appears to the incurious to have only one root, which is long, thick, and perpendicular, with a few short fibres about it : yet this is found, on a more strict examination, to spread a great number of fine small fibres to a great distance every way. These are its horizontal roots, they are of the same colour with the earth among which they run, and therefore they are not to be distinguished but by a very careful examination.

This is the case also with other plants, and nothing is easier than to be convinced of it by an experiment which Mr. Tull proposes. Let a piece of firm earth be dug in form of a long and narrow triangle, let the length be twenty yards, the breadth at the bottom of the triangle twelve feet, and at the top let it terminate in a point. In this let there be twenty turnips raised from seed, and let the ground be kept well hoed. When these roots are grown, if the turnips that stands first, or in the narrowest part, at the top of the piece, be as large as that which stands at the bottom, in the middle of the broadest part, it will be a proof that the horizontal fibres sent out by these roots, spread very little in search of nourishment ; for they cannot easily go beyond the part that is dug. If the turnips be gradually larger from the top to the bottom, it will shew that a turnip sends out small fibres to a great distance in search of nourishment, and that it grows in proportion to the distance they can extend. This would shew that a turnip sends out fibres, to at least six foot distance every way, for there is nothing else to make the last root bigger than the others ; and twelve foot is there the whole width of the ground that is dug. But if the first root be small, and those which follow in a line to the broader parts, grow gradually larger

till about the middle, and from thence to the broadest part, continue much the same in size and vigour; then it will be found that a turnip spreads its roots three or four foot every way, according to the breadth of the piece of ground where they have their full bigness: and that it sends them no farther.

Roots do not penetrate, in any considerable manner, into the hard ground at the edges of this piece, where it has not been dug. The experiment therefore, supposing this the event, would shew the great use of digging, hoeing, or plowing about roots, for furnishing them with nourishment: and it would shew, that be the earth ever so well prepared, it is of no use to them at a greater distance than three or four foot every way; therefore we should see by this, how much space is useful to be left about a turnip.

This experiment may be extended to other roots as well as turnips, indeed to all other plants whatsoever: and it will shew, sufficiently for all useful purposes, to what distance they severally spread their fibres.

CHAP. II.

Of the extent of the roots of trees.

MR. Tull observes, that the roots of white thorn in an hedge, which has a ditch before it, penetrate below the bottom of the ditch, and rise again on the other side, to the richer soil which lies near the surface, especially if it have been wrought; and then spread horizontally for more nourishment.

The same observation has been made by Mr. Du Hamel, with respect to a row of trees, which seemed to be kill'd by a deep ditch that was dug at a little distance from them, in order to prevent their roots from spreading into the neighbouring ground; but these trees, in a little time, sent down their fibres below the bottom of the ditch, which, when they had passed, they rose again toward the surface, and spread themselves through the soil that was wrought, to a great distance every way. The trees had faded at first, upon the digging of the ditch, but as soon as their new roots had got into the good ground, on the other side, they recovered.

If a ditch be dug lengthwise, at a small distance from a young tree, and filled up with good earth, the roots of the tree will soon get into it, and will follow the direction of the

the ditch, extending themselves in the fresh earth that fills it to a great length.

When trees are planted too deep in the earth, they languish till they have sent up their roots into the upper part of the ground, where it is stir'd by culture; but as soon as they have got there they revive and flourish. The folly of planting trees too deep, appears from this observation.

Of late years the young trees planted about London succeed worse than formerly, a good part of them dying, and other losing their tops: I have generally found this to be owing to the planting them too deep. One would suppose all the arts should be best understood near the metropolis, but that of planting is not: this hint may perhaps be useful.

These and other observations which might be cited, prove that the roots of trees spread to a great distance, when they get into ground that has been stirred; and that they will run a great way, and take strange courses to find it. The roots of all plants do the same.

Leaves are the organs of transpiration, roots are those destined for attracting and drawing the nourishment. In order to the growth of a plant, more sap must be taken in than is transpir'd; and as all plants encrease in growth, it is plain this is done. If we look upon the great extent of surface in the leaves of vegetables, we cannot doubt but that the fibres of their roots must be extended in a like manner. Reason shews it ought to be so, and late observations and experiments shew it is. It has been asserted, that they run out in length as much as the leaves expand in surface, although they are not so obvious to the eye.

But some restriction is to be observed in this assertion.

Plants transpire only in the day: during the night, they revive and imbibe the dews and rains, and what they thus receive contributes greatly to their encrease. There is no proof that either the transpiration or suction are proportioned to the surfaces of the parts; and for ought that is hitherto known, an inch of root may imbibe a larger quantity than an inch of leaf transpires.

But, however this may be, it is certain, that the roots of plants extend to a length, much beyond what has heretofore been imagined.

C H A P. III.

Of the manner wherein the roots of plants imbibe their nourishment.

AS the lacteal vessels in an animal have their openings in the intestines, for taking in the chyle, the roots of plants have openings in their lacteals, or sap vessels, on their surfaces. But there is yet a great difference: animals can seek their food, while plants are obliged to spread their roots in the soil, where they stand to imbibe their nourishment. It is therefore necessary, their roots should extend to a considerable distance, otherwise they would quickly exhaust the earth.

The pressure of the digested food against the inner surface of the intestines, contributes, together with the motion of those parts, to the introduction of the nourishing juice of animals, into the lacteals: and in the same manner the efforts which these small roots of plants make in extending themselves among the little particles of fine mould; the pressure of the wrought earth against the roots, and the reaction of the roots against the earth, as they encrease in bigness, and as that closes after the breaking by culture, answers, in some degree, to those motions in the intestines.

To this, which is an observation of Mr. Du Hamel, we may add another great article; which is the effect of heat. There is heat in all things; in the roots which are to receive nourishment, and in the earth which is to give it: and this heat differs in degree almost every moment, as is seen by experiments. Things expand with heat, and contract with cold: therefore they are expanding and contracting, more or less, every moment. This gives motion and pressure between the roots and the small particles of earth continually, and this much better shews the analogy there is between the nourishment of plants and animals.

This is indeed the true source of the nourishment and growth of vegetables; and all that has been discovered by Mr. Tull, and those who have followed his train of reasons, joins to confirm it. Heat is the cause of all motion, and is doubtless the immediate agent in the hand of the Creator, for the keeping the whole frame of things in order.

What has been observed of the action of the earth upon the roots of plants, shews, in the strongest light, the use of stirring and breaking the ground by culture, that the roots may

may the more easily make their way through it, and that it may press them as it closes after the breaking.

The roots of plants are always in the best condition for obtaining nourishment, when the soil is light and fine. If two young trees be pulled up, one from a light, and the other in a heavy soil, the tree which had grown in the heavy soil, has but a small number of roots, and those large and strong; whereas that which has grown in a light soil has a vast multitude, and all small and fine. To pursue this subject farther, let a tree be raised in pure water, where there is no resistance at all against the spreading of the roots, and we shall perceive that they are nothing more than the slenderest filaments.

The culture of a soil occasions the roots of whatever is sown in it, to be more numerous, and fine, and experience shews it is not from the large and thick roots, but from these small ones, plants receive their principal nourishment.

When a root is cut it alters its course and direction. This gives the greatest of all proofs, of the benefit plants receive from the digging about them. When a root is cut off, it does not extend any farther in its form, or course in length; but sends out a great number of small and fine fibres. From the cutting off one root, a number of others are produced, which are of the proper kind for drawing nourishment; and the ground is at the same time made ready to receive them, when this is done in digging about the plant. When the husbandman digs or plows near his plants, he cuts or breaks off a great many of their roots; and instead of hurting them by this, from every one so broken, there grow a great number of others more useful than the first.

CHAP. IV.

Of the importance and use of the leaves of plants.

LEAVES are so necessary to the greatest part of vegetables, that they cannot subsist without them. If we pull off all the leaves of a flourishing tree, it will commonly die. This is not always the consequence; for we see trees sometimes rob'd of their leaves by caterpillars, and they recover: but that is done gradually: most trees will die if strip'd at once.

The leaves of a tree which are to burst forth in spring,
are

are formed in the buds in the preceding autumn : they are at that time very small, but they are proportion'd to their use.

Beside these, which may be called the autumnal leaves, there is a reserve in plants for others : for when mulberry-trees have been strip'd of their leaves to feed silk worms, in the beginning of summer ; or when other trees have been rendred naked by insects, there grows a fresh quantity in the place. This is a provision of nature in favour of trees and plants, that they may not always perish by the loss of so necessary parts.

Grew discovered, in examining the leaves of plants, that beside the net work of longitudinal fibres, which form the course of the leaf, there are a number of vesicles fill'd with air. From this many have concluded, that the leaves were the lungs of plants ; that they received the air from the atmosphere ; that this made its way through the plant down to its roots ; and that it there produced an effect upon the sap received from the earth, of the same kind with that it occasions in the blood of animals.

Mr. Papin has published a great number of experiments, which seem to favour this doctrine. He says, that on putting a whole plant into the receiver of an air pump, it perishes immediately on exhausting the air ; but that if the roots alone be immersed in the receiver, and the stalks and leaves remain in the air, which may be easily contrived by letting them out, and securing the opening with wax, the plant will remain alive a long time. This was proposed by the author, and has been received by the publick as a proof of the respiration of plants, and that their leaves are the organs.

The experiments made by Dr. Woodward, Mr. Mariotte, and Dr. Hales, prove abundantly that the leaves are organs of transpiration, and that the greatest part of the sap imbibed by the roots, escapes through them. If we compare the quantity of sap that is taken in by the roots and other organs, with the quantity let off by transpiration, we find the remainder is what is left in the substance of the plant.

The leaves of plants imbibe the moisture of rains, and dews, and this is beneficial to the growth.

It is said the nutritive juice receiving a certain preparation with the leaves, is thence distributed throughout the whole plant for its nourishment : but this supposes a circulation of the sap, which is a thing not proved by experiments. Indeed it is much to be doubted, not only because

it has been advanced without proof; but because there do not appear to be two kinds of vessels in plants, as veins and arteries in animals; the one of which should carry up the sap, and the other bring it down again. All there seems to be in the motion of the sap of plants, is a kind of tremulous and uncertain undulation, owing to the different temperature of the air.

Those who argue for the circulation of the sap, say, that according to the other doctrine, it must be supposed to be prepared by degrees as it rises in the plant; and that there is not any experiment or fact to prove, that it is in a greater degree of perfection in the upper than in the lower parts: and it must be allowed surprizing, that the sap received into the roots, should be at once so perfectly prepared as to serve all the purposes of vegetation, and be able to supply with proper nourishment the several parts. Upon this plan of reasoning, the asserters of a circulation of sap say, it is altogether necessary for explaining vegetation, to allow that it passes through the leaves, returns thence through the body of the plant, and afterwards goes to the leaves again. This is specious reasoning, but there want experiments to confirm it; and, on the contrary, innumerable facts plead directly against it.

The transpiration of the leaves is all that is proved with certainty.

Whatsoever be the office of leaves, experiments shew they are of necessity to the whole; this is the husbandman's material consideration.

If one cut off half, or two thirds of the leaves of a young tree that is full of sap, it will lose its sap in a few days after. The bark which before would easily separate from the wood, will stick to it; and it will be impossible upon the very day after the cutting off the leaves, to perform upon it many of those operations in gardening, which might have been done while they were there.

A willow, or poplar, will flourish for a great many years, and continue with a sound trunk, provided it be left to the course of nature, and permitted to keep its head and branches; but, when one of these trees has the head cut off for shrowding, the trunk quickly decays and grows hollow. This is often owing to the wet that gets in at the parts where the head at first, or the shrowds afterwards are cut off; but if ever so much care be taken in the cutting, the tree does not continue sound as it would have done in its natural

natural state. The heads and high branches of trees are what carry the great quantity of leaves; and the leaves of trees preserve the very trunk in soundness.

On the same principle, injuries of the leaves of corn affect the ear. As soon as they are attacked by any disorder, the whole plant declines. This is a proof like the former, that the leaves are of the utmost importance, and that the healthful state of the whole depends entirely upon them.

The leaves of plants therefore are of the utmost importance: and so are the small branches that support them. Cutting, if it be done too close, is for this reason certain destruction to the French furze, and many other shrubs; and to the same principle is to be referred the vast damage that is done to the saintfoine, lucerne, and clovers, when they are permitted to be eat down too closely by cattle, while they are young. The injury is of the same nature with that to trees by shrowding: they suffer extremely while tender, though when their roots are well formed, and have spread far into the ground, they will recover it.

Our husbandmen turn in their sheep upon corn fields, when the young blade is too rank: we shall advise some limitations to this practice; and they will be founded on this principle, of the great and necessary use of the leaves to all plants, and the injury of cutting, or taking them off.

From these observations the husbandman will be led to the reasons of those effects he sees arise from culture. The roots of plants differ in form, and we shall find they also differ in their principal uses. The tap roots which penetrate deep into the body of the ground, serve to keep the tree or plant firm in its place, and those which spread in the upper coat of the earth, supply it with nourishment. One kind may be most needful to one sort of plants, and the other to another; though every plant in some degree requires, and has the assistance of both. Nature has given them according to their occasions, the oak and the walnut have vast tap roots to secure them from the violence of the winds, while humbler plants have the horizontal roots most considerable, for supplying their useful products with nourishment.

Nature answers different purposes by the same means, and often employs these tap roots also to draw nourishment. They are common in many plants which have no great head, as saintfoin and lucerne, and others; but in the general course of things, it is the other use to which they principally

pally serve. In the same manner, the spreading roots destined to supply nourishment, assist also, and that greatly in keeping the plant in its place.

These spreading roots grow to the greater length as they run nearer the surface of the ground, because they are there most within the reach of rains and dews, and most under the influence of the sun's rays: they extend farther and wider in proportion to the condition of the ground, and they always run farthest where the soil is most broken by culture.

We find leaves are of importance to the plant on a double account; as they discharge the redundance of juices taken in by the root, and as they contribute to its absolute increase, by imbibing nourishing matter from rains and dews: these two offices are performed by the same organs, and thus nature reciprocally uses them. They discharge the redundances by day, and they imbibe moisture during the night.

What has been said here concerning roots, is a matter of immediate concern in the cultivation of every kind of useful growth; and the knowledge of this effect of leaves will be of no less consequence in the consideration of many of those particular vegetables, the cultivation of which will be hereafter delivered.

CHAP. VI.

Of the nourishment of plants.

NOTHING is more difficult than to say, what is the nutritive juice of plants: no question has been more debated by philosophers, and none with less success. It would be natural to think this might be discovered by the nature of manures; but we see the effect only: nothing is more hidden than the cause.

We have shewn what are the several substances used as manures, and from many of these one would suppose, the sap which is so evidently increased and enriched by them, consisted of salts and oils, such as chymistry is able to extract from these ingredients: but the effects of many of the more simple manures, which are often equal to those of the most seemingly powerful, shew this is not the case. We are the more confirmed in this, when we consider that bare sands will support many plants; and that others may be raised in pure water; and that in either case they have the

the same qualities and virtues with those raised in earth, dressed with the richest manures. This leads one to imagine, that the sap, or absolute nourishment, is a thing much more simple than we should otherwise think; and that it obtains all this variety of tastes, smells and qualities from the organs of the plant.

Mr. Tull is of opinion, that the nourishment, or as he expresses it, the food of plants, is nothing but the particles of earth reduced to a very fine powder. Others have had recourse to salts as the great article of the nourishment of plants; and many have called in fire, air, and water, to serve the same purpose; some preferring one and some another of these, according to the systems they chose to favour. But this has all been found imaginary, from the result of frequent trials. If we can suppose pure earth capable of being reduced to solution in water, or but of being so broken and divided by it, as to be in a condition to be received into the finest vessels of plants, we shall adopt an opinion much more agreeable to reason, as well as to the common course of things, in supposing earth itself thus reduced to small particles, is the very matter of the nourishment of every thing that grows on it.

All vegetables are finally reduced to earth by corruption, and to what should a thing be thus reduced, but to that substance of which it originally consisted. The manures we add serve no other purpose than preparing that earth for entering these fine vessels; and the utmost effect of them perhaps is nothing more than rendering the earths with which they are mixed, fit for that purpose.

All the rich manures contain a salt: and salts may have an effect in dividing the particles of earth, and thus preparing them for affording nourishing plants. Water may soften these particles thus rendered extremely small, and air and fire may put them in motion. In this light, fire, air and water may assist in the growth of plants, but it is earth that affords the substantial part, or matter of their nourishment. The plant may be killed by taking away the effect of fire, air, or water, but without earth it could not have its very substance. Perhaps it cannot live without the others; but without this it cannot exist.

The mention of salts, fire, air and water, on this occasion, is unavoidable; because all who have read upon the subject, have been accustomed to hear of them as the sources of nourishment jointly or singly; but no knowledge

ledge was ever conveyed upon such principles. They are necessary to be named because they have visible effects; but nothing is so idle as to suppose they essentially feed and support them. Water in the condition we have it, will do this, but water contains earth; and it is by this earth, that plants are nourished which grow in it.

We do not mean by earth, that simple elementary substance which chymists express by the same word: on the contrary, we can extract all those principles from plants, and we mean by earth on this occasion, common mould.

That this is natural to plants is evident, because it will not injure them; which all the other things pretended to afford them nourishment will. Too much salt will prevent their growth, too much water will kill them, and too much air and heat will dry them up; but too large a quantity of earth never does them harm. Indeed they may be injured by being planted too deep, because their roots may be buried in such a manner, as to be out of the reach of the air, rains and dews, and of the influence of the sun's rays; these being necessary to their growth, although they do not afford them the real nourishment.

That earth is the nourishment of plants appears from this, that such as naturally grow in the most distinct and distant places, are capable of being supported by any earth indifferently in either. Thyme will not grow in a bog, because thyme does not love much wet, but the earth of the bog is not in fault, for that will feed it, if divested of its abundant water; and removed to another place. Let a parcel of the earth of a quagmire that bears nothing but rushes, be dried by the sun, and placed at the top of a hill, and thyme will grow in it; and in the same manner let the earth dug from a hill be buried in a quagmire, and when it is well wetted, rushes will grow in that. 'Tis not the earth that differs: 'tis only altered by the quantity of water. The plants of America succeed very well in the earth of England: if they are from a hotter climate, they must have a proportioned degree of heat given by art, but our earth does perfectly well. We see good earth will support and nourish all kinds of plants, provided they have the necessary degree of heat and moisture.

'Tis said that water, and even air, may be fixed and converted into earth; and some have imagined this of water particularly, from its so freely feeding of plants: but that is owing to the earth it contains. If we can get over the

difficulty of earths not being dissoluble in water, or can suppose that without solution it is capable of being rendered so small, that it may enter the finest vessels of plants; there appears great reason on the side of this opinion, that earth is properly and truly the food or nourishment of them.

The succeeding chapters on tillage will shew the necessity we have been under of entering thus far into the present subject: for otherwise, much of the practical part would have appeared strange and ill-founded. But whether earth be the nourishment of plants or not, is to the practical husbandman no important matter. If we can upon these principles lead him to a method of giving greater fertility to his land, we shall not be uneasy about the uncertainty which reigns, and always will reign in the enquiries into the mysteries of nature: the explanation of the nourishment of plants being one of the greatest.

C H A P. VII.

Of the reasons there are for supposing the nourishment of all plants the same.

A Question will naturally arise, whether we suppose the different sort of plants take in the same food, or the same matter for their nourishment, whatsoever that be? this is necessary to be considered for the use of the practical husbandman: for on the answer depends his knowledge how to act in the varying or continuing the same crops upon the same piece of ground.

The nourishment taken in by all plants is probably the same, for we suppose that nourishment to be no other than earth carried into their vessels by water. But as a great deal of the husbandman's practice will depend upon the certainty of this point, we shall not attempt to force the opinion upon him: but shall lay before him the objections that have been made, or may be made against it, and propose at the same time our answers. When he has the whole before his eye, he will best determine, whether he shall adhere to this or any other opinion.

Mr. Tull is the founder of this doctrine, that the food or nourishment of plants, is earth; and consequently, that all plants take in the same. The generality of writers have adopted a contrary doctrine: they suppose every plant draws from the earth for its nourishment certain juices that are proper

proper for it, and no other, never taking in the earth itself at all.

On this principle is founded the common opinion, that a piece of ground may be exhausted for one kind of plant, and not for another; and on this opinion is supposed to rest the custom, of every year changing crops; the success of which practice is also urged in favour of the opinion.

Barley, they say, exhausts the ground more than oats, when it is to be sown afterwards with wheat. This is a fact, and on this they found their opinion, that the juices taken for the nourishment of barley, are more like those required by wheat than are the juices drawn by oats.

In the same manner they add, when a piece of ground has been a long time occupied by one kind of tree, if more of the same sort be planted in it, they will succeed very poorly; but if trees of some other kind be set, there will be hopes of better success.

These facts which we state in their full strength, allowing their truth, seem at first sight to argue against the nourishing matter of all plants being the same: but, on the other hand, there are a multitude of observations founded also on facts, which stand as fairly for the opinion that it is.

Barley does really exhaust the ground, on which wheat is afterwards to be sowed, more than oats: but the fact is only that barley exhausts ground more than oats. There is nothing in the supposed particularity. Wheat requires a great deal of nourishment, and it succeeds best after oats, not because the nourishment drawn by barley was of the same nature that wheat required, or that drawn by oats different; but because the barley had drawn more nourishment, and therefore had left less in the ground. We know barley requires more nourishment than oats, for oats will grow on poorer land: and this is the whole matter. The fact proposed is true, but the cause has been mistaken.

The other objection, if it were stated more particularly, would be as easily answered. Oats requiring little nourishment, will succeed after crops that require more; and that when the same crops would not. In the same manner some trees require more, and some will thrive with less nourishment. When one kind of tree that requires a great deal of nourishment has exhausted a piece of ground, a fresh quantity of the same trees planted on it will not thrive, because the former had impoverished it: nor would any other kind of trees succeed, that should require a great deal of

nourishment. But if a kind of tree be planted there which requires less nourishment, they may succeed, because though there be but little, it may be sufficient for them, as they require but little.

A great part of the objections which are proposed against useful discoveries, might be answered by more strict enquiries in this manner; they have had their rise in error, and they have their appearing weight only because they are stated imperfectly.

C H A P. VIII.

Other objections to the nourishment of all plants being the same, answered.

THE principal difficulty they raise who suppose every plant to draw a peculiar juice for its nourishment out of the earth is, that it does not appear probable the same matter, and that alike in all respects, should be able to support and give increase to such a variety of plants, and those so different from one another; in their forms, tastes and virtues.

This has a specious appearance: but let it be considered fairly. There is no doubt but the small particles of earth which we suppose to be the nourishment of vegetables, assume different forms in different plants; but this is no proof that the nourishing matter may not be the same in the earth, though altered in their vessels.

Experience joins to shew, that the nourishment is the same for all plants, from their growth among one another. If a lettuce draws from the earth a particular juice for its nourishment; and that juice be different from what is drawn by a plant of succory, it will follow that a lettuce set among succory plants, must flourish better than when set among other lettuces: nay, it ought in this case to flourish as well as if no other plant at all were near it: but let the experiment be tried, and the result will be quite otherwise. A lettuce planted among succory will flourish just as much as if it stood among other lettuces; not at all more: and it will not grow nearly so fast, as if no plant were by it. This shews the nourishment of lettuce and succory are the same; and that plants of any kind exhaust the ground.

That the nourishment of plants, undergoes in their vessels that change which gives it the particular taste, colour, and form belonging to the plant, is evident from the com-

mon effects of grafting trees. There is an instance of Mr. Du Hamel's, in the memoirs of the French academy, which proves this abundantly, and in a very particular manner. A young citron of the bigness of a pea, was let in by the stalk to a branch of an orange tree. The citron grew to its full bigness, and became perfectly ripe, but it was to all intents and purposes a citron; having nothing of the orange in its nature, form, taste, or appearance.

Now if the nourishment received by the orange tree could be thus prepared in the vessels of the citron stalk, and fruit, what reason can there be to doubt, but that the same nourishment taken up from the earth, may be wrought in every plant into the colours, qualities and forms that are peculiar to that plant. Some contend not only that there is a particular juice taken out of the earth by each plant for its nourishment, but that every plant has more kinds than one. The pulp of a peach, the stone, and the kernel, they observe are very different things, and they say there ought to be three different juices taken up out of the earth to nourish them.

These betray the cause by saying too much. Doubtless the organs and vessels of plants give the different taste and smell to the sap, as well as occasion its various other effects in the different parts. We do not find in the earth the taste either of the pulp, of the peach, or of its kernel. There are soils that communicate a peculiar taste to the fruits, but this is given equally to all fruits, and is perfectly different from their own, which each has beside. The earth has a taste, which it communicates universally; but the same effect is produced beside in the vessels of the several trees, and plants, as in other places.

In the most strict examination of the roots of plants, we find no preparation for receiving particular juices. Grew shews that the surface of roots is a spongy substance, which must receive all juices alike; and that the surfaces of all roots are such. These spongy openings admit the fine particles of earth for nourishment, and the organs of the plant give them their differences in the various kinds, as well as in the various parts of the same.

Plants of the most different nature may be raised in water, and they will all have their particular forms, tastes, and colours. Will these people say that there are in water different juices to be taken up by different plants? that were absurd. We say there are particles of earth in all

water, which is a known fact: and that these are taken in by the roots of plants for their nourishment: that they are in themselves perfectly alike, and are taken up indifferently by all, but that they are changed in the organs of the plants, in order to give them their forms, tastes, and colours; this surely is reasonable.

The advocates for particular juices say, as there is a necessity for a distinct juice for nourishing each several part of the same plant: it cannot be but that the roots of every kind are so formed, that they will receive or admit no juices but such as are appropriated to that plant; and that the several parts of the plant afterwards appropriate again such juice as is alone suitable to them.

No doubt but according to the system of different juices, this ought to be the case; the question must remain whether it is: and on the decision of that, the whole objection will stand or fall. Mr. Tull has produced an experiment on this occasion, the result of which, as he relates it, is altogether decisive. The experiment is this. Set a stalk of mint in a glass of water: it will grow there and shoot out many roots. Let some of these roots be got out of the fresh water, and plunged into a glass of salt water: in this case the mint will presently die, and its leaves will taste salt.

In this case there is no doubt but the mint is kill'd by the effect of the salt water upon its roots; because if the same roots had been cut off, the plant would not at all have suffered: and the salt taste of the decayed leaves shews plainly, that the salt was the cause of its destruction. This fact rests upon the credit of Mr. Tull, who has related it; and he asserts from it, that it is a proof that roots take in indifferently any nourishment that comes in their way, even when it is of a kind that will destroy the particular plant they are to feed.

CHAP. IX.

Reasons deduced from the practice of husbandry.

TIS said the practice of the husbandman, and its success, prove there are different juices in the earth for the nourishment of plants. Why, say they, are barley or oats sown after wheat, and not wheat again, but that the wheat has drawn all the juice fit for its kind, so that the next crop of the same species would be starved; whereas there

there still remains the nutritive juice for barley, and that for oats, which therefore flourish, though a second crop of wheat would not.

The real cause we have shewn already; it is, that wheat requires a large quantity of nourishment, so that there does not remain sufficient for a new crop: but oats and barley require less: if it were true that barley grew well after wheat, because the wheat had left in the ground the nourishment proper for it; then in consequence a good crop of wheat might be expected after barley, because the barley would have left in the same manner the juices proper for that, and the ground would be the same as if nothing had been sown on it before. But this does not answer in practice, and we may therefore be sure it is not true. Such a sowing of wheat would yield a very bad harvest. Wheat does not succeed except the land have had four workings: if barley were sown in land so prepared, it would thrive greatly, but as it does not bear the price of wheat, nor necessarily require so much preparation, they sow it after two.

Barley will grow upon land that has been impoverish'd by another grain, therefore it succeeds after wheat; but wheat will not thrive unless it have the land fresh, and thoroughly prepared to give it nourishment, and therefore wheat will not do after barley.

If every plant drew from the earth a particular juice, and no other; what occasion could there be for letting the lands lie fallow one year in three, as is the custom in common fields. They might only have a change of crop. If they sowed wheat the first year, barley the next, and oats the third, and then pease and turnips; they might after this last growth sow wheat again, the land having had five years to recover the nourishment of wheat: but this is not found in fact, nor is there any truth in the argument. The nourishment of all plants is the same, and is probably no other than earth in small particles, and there is no other difference, but that one kind draws more of it than another.

Every one knows, that in such a course as this, all the crops would grow worse, till they would not be worth gathering: this is because all crops exhaust the earth of the general nourishment of plants, though in a different degree.

Rest is not all that land has during the intervals of crops for its recruit. It is turned and worked, by which means

the particles are anew divided, and there is a fresh supply of small ones procur'd for the affording nourishment to the following growths. The texture of the mould is broken so, that it gives free passage to the roots of corn in new places; and by all this it is render'd proper for the production of plants which require a great deal of culture, wheat particularly: and during the whole time of this rest and preparation, it is not exhausted by useless plants.

If every plant drew from the earth a particular juice, and that of no other kind, then thistles, bluebottles, corn marygold, and the other weeds so frequent among corn, would do it no harm; because they would take only such juices as the corn would not, but the contrary is found in fact. All these plants injure the growth of corn, because they all exhaust the earth of its nourishment, which is the same for one and for the other.

If other plants did not draw from the earth the same nourishment with corn, corn might as well grow among the largest clusters of them, as singly in a field: but we find it will not: and 'tis not to be pretended the stalks of the plant prevent this any way, because so many sticks of dry wood will do no harm.

C H A P. X.

The result of experiments in vegetation.

MANY have thought every thing that can be dissolved in water, enters indifferently into plants; and that each separate kind appropriates only what properly belongs to its nature, and lets the rest pass off by transpiration.

This, like the other reasonings, has a very fair appearance, but it cannot stand before experiments. We can collect what passes off from plants by transpiration: Dr. Hales has done it, and the result has altogether contradicted this system. Seeing what great quantity of matter perspired, says he, I was desirous to try if I could get any of it. I fixed glass retorts to trees of different kinds, taking in their boughs with the leaves on into the retort, and stopping up the mouth about them. By this means, says he, I got several ounces of the matter perspir'd by vines, fig trees, apple trees, cherry trees, apricot and peach trees, also by rue, horse-radish, rhubarb; and by parsnips, and cabbage leaves. The liquor of all of them was very clear,
nor

nor could I discover any different taste in the several kinds: and the specifick gravity was very nearly the same with that of common water. Here was a great variety of plants and trees try'd, and if there were different matters to be transpired, these certainly must have shewn that difference; but upon this fair experiment there appeared no such thing, the liquor obtained from them was in all respects the same, it was perfectly like common water, and shewed no other difference from it, than that it would stink sooner: this shew'd that it took something from the plants, but the same from all. Having passed through their vessels it acquired some vegetable quality, but that was the same from any plant. This experiment is the seventeenth in Dr. Hales's vegetable statics, it is easily repeated; but the authority of that writer is sufficient to establish it; and it overthrows that system.

If each plant took up all that could be dissolved in water, and transpired what it did not want, the ground would be continually exhausted. For what was thus transpired would float in the air, and be at the mercy of the winds, to carry which ever way they chanc'd to blow.

There remains a farther observation to be stated.

When land which would no longer bear corn well, has, for some years, bore saintfoin or lucerne, it will again bear great crops of wheat. This may seem to shew, that the substance necessary for nourishing wheat, and that necessary for nourishing these plants is different; and consequently that the food of plants is not the same. In farther support of this argument it may be observed, that grounds laid fallow, to give them strength for corn, bear in that state great quantities of weeds. This should seem also to shew, that different juices in the ground are fit for the nourishment of different plants; and that it is not the substance of the earth which serves for all: let not the industrious enquirer stop at appearances, but proceed to a deeper and a fairer search.

Those lands which are only left fallow, and have nothing done to them, do not improve either so quickly or so perfectly as if they had been tilled during that interval.

The greater part of those plants which grow upon fallow lands, are weeds of slight roots which spread just under the surface, and do not penetrate to any depth; consequently, when these lands are wrought, and the lower part of the soil is turn'd up, this is mould which has lain in absolute repose.

repose. Now the contrary happens when saintfoin and lucerne are sown, for they root very deep: but for that reason they do little prejudice to the soil near the surface. It is found by experience, that these plants draw their nourishment from a great depth, and leave the superficial part of the earth unexhausted.

Thus this observation ceases to be any objection at all. Weeds on fallows, exhaust the surface only, and that surface is turned downward in plowing; so that the earth which is turned up for the growth of the corn is not exhausted by them. It has lain its year in repose, and is now fitted for the nourishment of corn, by turning and breaking. Saintfoin and lucerne root deep, and draw their nourishment from the lower part of the land; so that a field cover'd with these grasses, has the upper part of its soil in a state of repose; and when that comes to be wrought and turn'd up, it is fresh and fit for the nourishment of corn, for corn is the most superficial of all growths in its rooting. The case is not that weeds and saintfoin draw only a particular nourishment, that makes corn succeed after them; but it is that weeds exhaust the surface which is turned undermost in plowing, and the others exhausts the earth at depths whence it is never turned up for corn; and all the time of their growth, that part of the soil in which the corn afterwards is to grow, lies quiet.

Plants with tap roots do not succeed upon land where other plants with the same kind of roots have been. Lucern will not thrive after saintfoin; whereas those plants which have spreading roots, succeed upon the lands that have born the deep-rooted ones excellently; 'tis plain therefore, these deep-rooted plants have exhausted the earth of its nourishment at those depths, but not at the surface: and it is extremely probable, from all appearances, that the nourishment of all plants is the same, and that it is nothing but earth in small particles. We see those of any kind exhaust this nourishment, according to the depth at which they root; and no otherwise. When it is exhausted, the earth must be prepar'd in order to the giving more; and as it consists only of small particles of mould, any thing that breaks and divides the land answers this purpose. The air does this in fallowing; the plow does it in turning and labouring, and the different manures do it by fermenting the soil. All these things produce the same effect by several different ways, and consequently in different degrees; but

whatever will break and divide the particles of earth; will make it proper for the support and nourishment of plants.

CHAP. XI.

Of changing of crops.

HAVING explained the nature of plants, and their nourishment, our farmer will understand the reasons of all that shall be proposed to him for practice; and, where any thing out of the common road is to be proposed, this explanation is needful.

We find all plants are nourished by the same substance; that every plant will exhaust the earth of its nourishment, which would be fit for others of the same growth; and that a piece of land which was once fit for supporting a crop of any kind, will continue to nourish crops of that plant for ever, if it be properly tilled and managed.

This is an article of great consequence, and perhaps little believed by the common farmers, but it is equally true with the others; and may, at any time, be prov'd by experience. Let those who would deny it, first try.

It is not necessary to change the crop every year, upon the same land: and this makes way for a new method of husbandry, and for vast improvements. It is on these facts that the horsehoeing system has its foundation.

In following the common practice of husbandry, there is a great advantage in the sowing successively different species upon the same land; but this is not owing to the supposed cause, that each exhausts the earth only of its peculiar nourishment, leaving the proper juices for the others.

There are three causes which may occasion this good effect of changing of crops. but all different from this supposed cause. The first is the various quantity of nourishment requir'd for different plants; a second is the different formation of parts in each plant, some being much more delicate than others; the third is the different quantity of tillage which each kind of crop requires for the ground. These are the real causes why a second crop should be different from the first, and a third from the second.

All plants do not draw from the earth the same quantity of nourishment. There are poor and light lands which nourish rye very well, though they would not yield a crop of wheat, nor even of oats. On the other hand, there are plants which are able to plunge their roots into a hard soil, which

which others cannot penetrate. The roots of oats will penetrate a hard land better than those of barley: therefore oats will grow with less tillage. Oats succeed tolerably well in many places, where the soil is hard, with only one dressing: whereas lands that are much lighter and softer, require two, in order to produce a good crop of barley.

From this we may conclude, that in following the common practice of husbandry, some other corn should be sown for the next crop after wheat: because wheat requiring several dressings, in order to yield a good crop; and requiring also to be sown in the beginning of winter, or soon after harvest, it would be impossible to give the land those dressings, without which we know, from experience, it will not succeed. With respect to oats and barley, as they are not to be sown till the following spring, there is time between the gathering the wheat harvest, and that season, to give the land the one or two dressings which they severally require.

The years fallow that is given to prepare for wheat, affords opportunity for those four dressings, and for all the advantages which the land receives from the air and rains, between one of them.

If any one should take a resolution of always raising wheat upon the same land, he must sow it only every other year. The year between must be a year of fallow, and must be used for the giving the land its four dressings; and in this manner the same field would for ever yield large crops of wheat, without ever sowing any other corn.

Mr. Tull produces an instance which shews wheat will not, in any condition, succeed upon land that has not received its proper number of dressings. He says, that on sowing a piece of excellent land with wheat, in the usual way, it grew so thick and heavy that it lodged, and little grain was got at harvest: after this the owner seeing the richness of his land, thought it would bear this grain any way, and giving it only one dressing, sowed wheat again, expecting, that as the growth would be now less strong, he should have a better harvest; but he was disappointed, he hardly obtained from it the quantity of his seed corn.

Wheat succeeds very well after turnips; and people from this have fancied, that the nourishment of turnips was different from that of wheat; this is owing to a very different cause. The great requisite for wheats succeeding is, that the ground be very well dressed. Turnips are always sown on

on ground that has been well work'd ; and it is dress'd over again as they are growing, Therefore, when the wheat is sown afterwards, it has a land more labour'd and dress'd than in the customary way.

Turnips exhaust land very little, unless they be suffered to run to seed. Nor is this all : we find that the nourishment the turnip does exhaust, is little more than water, so that less of the earthy matter going into them, the more is left afterwards for the wheat. This fact may be proved by experiments on the roots themselves. If a large quantity of turnips be mixed with wheat flower, and made into bread, when the bread is weighed, there will be found little more of it than if the same quantity of flour had been used without the turnips.

If turnips are sown upon a land intended for wheat, and eaten off before they run to seed, the land is better prepar'd for that corn by their growth, not being in any considerable degree exhausted ; and the cattle eating these turnips upon the spot where they grow, their dung and urine add greatly to the richness of the ground.

When saintfoine has grown upon a piece of ground, there must be care in introducing wheat upon it. This ground not having been dressed or turned for nine or ten years, while the saintfoine was upon it, will not be sufficiently broken by one or two plowings. One or two will prepare the ground for oats : but more are necessary for the success of wheat.

Although in the ordinary way of husbandry, it is impossible to have wheat every year upon the same piece of ground, with success ; yet in the method of horsehoeing husbandry, it may be done. All that we have been here premising, is for the explanation of that practice ; from which, managed with prudence, he may, in most cases, make a much greater advantage of his land than by the common methods. A crop of wheat may be thus advantageously raised every year upon the same ground. The means upon which this will depend are, to give it more dressings ; to put the plant in a condition to spread their roots in this prepar'd earth in the most advantageous manner, for the obtaining the nourishment wherewith it abounds ; to prevent weeds from robbing the crop of its nourishment ; and to be careful not to raise upon the land more plants than can be subsisted. These are the principles on which the practice
known

known by the name of horsehoeing husbandry depends, and these are founded on reason.

C H A P. XII.

Of the distribution of the nourishment of plants in the earth:

THE great advantage of a year of fallow is, that it gives time for sufficient dressings. These must be given at proper intervals, for otherwise they have not half their effect. Between one dressing and another, the weeds that are plowed in should have time to rot, and the earth must be new turned up to the sun and rain. A second dressing coming immediately after the first, would only throw up the same land again, undoing what the first had done in a great measure.

From this the considerate reader will understand not only the necessity of dressings for land, but the nature of their benefit.

However good a soil may be in its nature, the plants sown in it can have little advantage from its richness, if their roots cannot spread and penetrate it to get at the nourishment. A soil that is too firm will not permit this, its riches are as it were locked up; and it must be broken by dressings. The vast fertility of garden ground is owing greatly to this continual stirring and breaking of it in digging, and we see all earth is fruitful that is frequently moved. We may therefore establish it as a principle, that the more the small particles of a soil are divided, the more its inward pores are multiplied; and it is in proportion rendered more fit for the nourishment of plants. We have said how great things may be done in the improvement of land by manures, we now come to the article of dressings: on the proper understanding of those two things depends all the knowledge of husbandry.

The common practice rests most upon manures; the horsehoeing husbandry on labour and tillage: this is their great difference.

The nourishment of plants is spread throughout every part of the earth, but it would answer no purpose if plants were not able to draw it. To this purpose it is necessary, that they have the means of spreading the small fibres of their roots between the particles of earth in a soil. Land in
which

which these particles are pressed too close, or connected too firmly together, prevents this passage of the roots; but it is necessary that there be spaces between these particles into which those roots may run. Most soils have naturally these inward pores, but frequently they are in too small quantity, or they are not of proper kinds and proportions. This is the natural defect of soils, and this is to be remedied by dressings.

When the pores are in too small number, there is little communication between one of them and another; and the roots are stop'd in their passage; this is the fault of too stiff soils.

When the pores are too large, the roots go through them almost without touching the earth, they therefore can take no nourishment from it: this is the fault of too light soils.

These defects may be remedied by culture; the earth contains so great a quantity of nourishment, that there is no need to fear exhausting it; the only business is to put the roots into a condition of getting at it.

Neither are we to fear this nourishment, intended for plants, will be scattered and lost of itself: experience shews there is no such danger. If we dry a piece of earth ever so thoroughly, and then powder it fine; if we expose it in this state to the sun, rains, and frosts, it will not have its nourishing particles dissipated or lost by this; but all that management will render it more fertile. This shews the nourishment is real earth, water is necessary to be mixed with the particles of earth, and when this has carry'd up the nourishing particles into their vessels, it is transpired through their leaves, leaving those particles behind. This is the course of nature in the supplying of plants; but when water is evaporated from the earth, without passing with it into the vessels of plants, it goes off alone, taking with it none of the nourishing particles. Lands left fallow grow more rich and fertile; whereas, were the water that is evaporated from them to carry the nourishing particles of the earth along with it, they would be rendered poorer by this practice.

In the management of land for giving it fertility, what we are to attempt, is not so much to provide plants with such particles as are needful for their nourishment, as to dispose these in such manner that the plants can gather them up, with their roots. Almost all soils contain the nourishment
of.

of plants in abundance: the husbandman is to put them into a state fit to give it.

This is done by a proper dividing and breaking of the particles of the earth; this must be done in such a manner, that those particles may leave between them as great a number as possible of little spaces, into which the roots may insinuate themselves, so that immediately touching the particles of earth, they may gather from them those extremely fine and minute parts, which are their real and proper nourishment.

This dividing of the soil is to be done two ways, by manures and by tillage: we shall, in the succeeding chapters, examine impartially by which of those means it may be best obtained; for on that depends the merit of one or the other kind of husbandry. It is by understanding their different operations, the practical farmer must be directed in his choice, which method to prefer on any particular occasion; and how to manage his ground to the greatest advantage.

BOOK VI. PART II.

Of the advantages of TILLAGE.

CHAP. XIII.

Of the several methods of dividing the particles of earth.

THE means of giving fertility to a soil, consists in the dividing and breaking of its particles. We are now to examine in what manner that effect may be best effected; and we shall do this with impartiality. The favouring a particular system may mislead men, but they are safe from prejudice who have no aim but the discovery of truth.

Beside the two ways already mentioned, which are by tillage and manures, there is another to be remember'd here, which is heat, or the effect of fire. The difference of the three ways is this: tillage operates mechanically, breaking those particles merely by the instruments employ'd in it; fire acts in the way of calcination; and manures by fermentation.

Dung, which is the principal, alters in some degree the nature of the productions; and there is another disadvantage,

tage, which is, that we cannot procure it always in the needful quantity. It is always in our power to increase the tillage as much as we please, and this never alters the quality of the products. Dung and other manures may give some substance to the earth; but repeated dressings expose one after another, the different parts of the ground to the influences of the sun, air and rains; and these render it in a more natural manner fit for the affording nourishment to plants.

The more we break the particles of earth, the more we increase the number of its inward pores: the more we increase the surface of those particles, the more we put the soil in a condition to furnish plants with nourishment: that is, the more we add to its fertility.

It is in our power to effect this by fermentation raised by manures, or by the instruments of tillage: the use of dung is limited, because the quantity is limited; but the method by tillage is without limitation, because we may always give as much as we please.

Dung spoils the taste of the products in some degree: this is proved in kitchen gardens. The eatable plants raised with dung being much worse tasted than those without. Cabbages and pulse are never so well flavoured in great towns, where they are raised with abundance of dung, as in the country where dung is scarce, and less of it is used to them. In wine countries this effect is the most obvious of all, the difference being surprizingly great between wine made from the produce of a vine that has been dunged, and that from grapes of the same kind where there has come none of that manure.

These are the real and certain disadvantages of dung, especially when used in too great a quantity: Mr. Tull has carried this point farther. He attempts to prove that dung gives hurtful qualities to the plants raised by its assistance: but the fondness for his system carried him in this beyond reason; and his arguments are not conclusive.

It is probable, a poisonous plant would have less power when raised in a rich dunged soil, than in the poorest natural earth; for we find dung, though it increases the growth of plants, weakens their qualities.

Dung by fermentation makes an inward division of the particles of earth, which must be useful in giving its fertility: but the instruments of tillage break those particles, and at the same time change their place: they turn about

the larger parts of the soil, and give them all the advantage of the seasons, at the same time they destroy weeds. The improvement which is made by tillage has many advantages, whereas that made by dung has but one. The earth thus dressed is not exhausted by useless plants; and it receives from time to time, and in all its parts successively, the advantages of the dews, rains and sun, all which we see, from manifold experience, assist greatly in giving fertility to land.

Dung draws insects together which eat the produce. When trees are planted in a dunged ground, their roots suffer by insects; and the curious in flowers have for the same reason banished the use of this manure from their practice.

A very good method to remedy this evil, is to mix lime with the dung in the making up the heap. Let a layer of quick lime be first laid for a foundation, and then as the dunghil rises by the addition of fresh quantities of dung, let there be here and there a layer of lime spread between. This will not only destroy insects, but will kill in great part those seeds of weeds which are one way or other received among the dung, and produce them too often in abundance among the corn.

It is represented as a great advantage of dung, that it is useful on all kinds of soils, the light and the heavy: and there are few exceptions to this. But the same is true of tillage: for it equally agrees with the stiff and the loose soils, and gives fertility to them all.

Stiff soils have their particles so close, that roots cannot penetrate them sufficiently; and when they cannot penetrate and spread in the earth, the plant languishes. When these lands have been broken and divided by tillage, so that the roots find passage among them, and can spread as they ought to seek nourishment, they will be able to supply the plants with food; and we shall see the crop grow upon them with strength and vigour.

The fault of light soils is, that they have too large spaces between their particles, and that many of these have not a communication with one another, so that the roots passing through these large cavities, do not reach their sides; and, consequently, not touching those small particles of earth which are the proper nourishment of plants, they cannot take them in, and of course cannot draw nourishment for the plant. The effect of tillage on these soils is this. It breaks the particles as in the other, and by that means multiplies

plies spaces between them, making a great many small ones instead of a few large ones. This it is obvious to reason must be the effect of breaking and dividing a light soil with large intervals; and this naturally qualifies it for affording nourishment to plants: for these small spaces have their communications between one another, though the larger, from the nature of the soil, had not, so that the roots of plants can penetrate into them, and run through them as they should; and at the same time touching their sides everywhere because of their smallness, they are able to take in those extremely minute parts of earth which are the proper nourishment of all plants.

In order to roots receiving their nourishment, there must necessarily be a kind of pressure between their surfaces, and the small particles of earth among which they run. This naturally happens when the spaces are small, though it could not when they were so large as they naturally are in light soils.

C H A P. XIV.

Of the degrees of tillage, and of the use of dung.

MR. Tull has endeavoured to prove dung useless on all occasions, as well as hurtful on many; and he is for banishing it from the practice of husbandry.

But the fondness for his system carried him too far on this article.

The origin of the horsehoeing husbandry, is laid in that passage recorded by Mr. Evelyn, where it is asserted that nothing more is necessary than the thoroughly breaking and dividing the particles of earth, in order to make it capable of nourishing any plant. From this it appears that nothing more is needful to the giving fertility to a soil than the dividing its parts, and breaking the little lumps into which they form themselves. This is true with respect to many kinds of soils, but it will not hold good of all. From this we shall shew the husbandman, there is danger in his adhering to any system or method too strictly; for although the benefit of tillage, in the manner it is proposed in the horsehoeing husbandry, may be greater than that of dung on many soils, it is not on all. The farmer, to make the most of every part of his land, should know every method of managing it; and he should prefer that kind to each part which is suited to its nature. We have laid before him the old

method by manures, we are about to propose the new husbandry, which places a particular kind of tillage in their stead: and we shall shew him, that neither is absolutely preferable, so as to render the other useless: but that one kind of management may do for one land, and another for another: we shall shew him where manures will be preferable to the breaking of the ground by tillage, and where tillage may be preferable to manures; and shall give him directions with respect to this tillage; as we have regarded manures: shewing in what degree the one, as in what quantity the other, may be useful to particular soils.

Mr. Evelyn has said, that breaking a quantity of earth, and exposing it to the weather, will render it so fertile, that it will support any plant. The horsehoeing husbandry, proposes to render a soil fertile by breaking and dividing it with tillage. But Mr. Du Hamel declares, that the fact recorded by Evelyn is not universally true, and therefore disputes the practice founded on it in some points, while he allows it its merit in others. He says the assertion is not true of all kinds of earth, for that he tryed it on clay, and found it did not succeed. He powdered a quantity of clay, and sifted it through a fine sieve; but after this, wetting it with water, it became as tough and stiff as it had been originally. This is the objection stated by Mr. Du Hamel, and though not so conclusive as he seems to think, it has its weight.

He has not on this foundation a just right to question Mr. Evelyn's fact, for he did not fairly try the experiment. He says he powdered and sifted the clay, but he does not tell us he exposed it to the weather. This is a part of the true process, and it should be so exposed a year. We have seen that fire in a proper degree renders clay fertile. We have observed also that the sun and air have in these respects the effect of fire, only that it is brought about more gradually. Now in this case the powdering of the clay would have rendered it more fit to receive the influences of the sun and air, and the continual stirring and turning of it, which is directed in the process, would have exposed every part of it at times to their effect; so that it is not easy to say how much the process fairly tryed would have done toward the rendering even pure clay fertile.

However, although the experiment be stated imperfectly, and does not infer so much as Mr. Du Hamel intends; yet this may be properly seen from it, that clayey soils will not be

be so readily improv'd by this tillage as the loamy and lighter kinds. The tillage of the horsehoeing husbandry alone, will be sufficient for light loamy soils; and on the other hand, the farmer who has such as are stiff and clayey, will do well to call in to its assistance the effect of sand, and the other proper manures; and when it appears necessary of calcination.

It is in this prudent and moderate way we recommend the horsehoeing husbandry to the practical farmer: and it is thus, and thus only, he should admit the use of any new methods. Their authors or inventors are always partial in their favour; but that may be beneficial on many occasions, which is not adapted to all.

Clayey soils are apt to grow stiff again, after tillage; unless it be assisted by proper manures; yet we are not for that reason to say, that for clayey soils, manures are better than tillage; for none require so much. Both are required for these lands: a great deal of tillage to break them, and then good manures to keep them in order. Thus from very indifferent they become some of the best soils we have; and it is thus the farmer is to manage them. Here therefore neither the old husbandry is better than the new, nor the new better than the old, but the true practice is to join them.

Manures are necessary to clays, after they have been divided by the tillage; and they are useful to light soils because they want the matter of nourishment. They enrich these and they divide the other: they are necessary to both, and they will take double effect on both, when they are accompanied with good dressings.

CHAP. XV.

Of the joint advantages of manure and tillage.

THE world has been sensible of the use of manures at all times, and it is the farmer's interest to continue the use of them; not to neglect them for any other practice: but this does not make the horsehoeing husbandry less useful. Where manures cannot be had in due quantity, this tillage will supply the place of them; and where they are ever so plentiful, it will be a means of giving them greater effect. The use of manures need not make the farmer less regard tillage; for the more the ground is divided by that means, the more effect they take.

Wheat, which is the strongest corn, and requires the most tillage of land, succeeds better when more is given than usual; and it is found by experience, that this may supply the place of manure. Four dressings are commonly given to the land for this corn, and the use of dung is added; if the farmer will give it eight dressings instead of four, it will succeed as well in most soils without dung. These additional dressings cost less than manures, and where they succeed, the effect is equal. They will at any time in part, and on many occasions entirely serve instead of manure, therefore it will be certainly to the interest of the farmer to use them.

Thus it is easy to see, there may be improvements made in the common practice of husbandry. The common tillage does not answer the farmer's purpose for stiff clayey soils. It breaks the earth in this case only into a kind of large lumps, with great irregular cavities between them; and such a soil is not in a condition to support plants well. For the farmer to use these lands to the best advantage, he ought to give them more than the common tillage; and by the repeated dressings in the horsehoeing husbandry, he is to break those larger into smaller lumps. By this means a stiff soil will be brought into the condition of a light one; and will be fitted for raising a good crop: manures are at that time to be added: they will be received into the body of the soil better than they otherwise could; and there will then require nothing more than a repetition of that practice which brought the land into this good condition, to maintain it in the same for ever.

Sand is a good manure for clay. This proves the advantage of tillage on such lands, for sand answers the same purpose in a manner with tillage. It breaks the soil, and lets in the sun and rains, and gives passage to the roots of the crop. This is what tillage also does, it furnishes no nourishing matter to the soil, but merely separates the particles of the earth; or keeps them separate when they have been broken by tillage: and this produces all the good effects we desire.

Light soils are improved by dressings, but they need not to be so frequent on these as on the others. To these manures are wanted to give richness, as to the others to divide and to keep the soil divided: but we need not be afraid of exhausting the fertility of these lands, by exposing them to the sun. Its heat evaporates only their watery parts, not that

that solid substance which is to be the nourishment of plants. All these lands are improved by dressings, whether it be from the breaking of their particles, making them more ready and fit to receive the dews and rains, and receive the influence of the sun and air, or whether from the multiplying their inward cavities, so that they are fitter for the spreading of roots. From which ever cause it rises, the effect is certain: and by these repeated turnings, weeds are destroyed entirely; whereas light soils are those which in the common methods of husbandry produce them most.

What is here said may be easily proved by experiment. Let one half of a piece of such land, be dressed in the common way, and the other perfectly broken and divided by the horsehoeing husbandry: after some time let the whole field be turned again in a dry season, and that crossways, so that the land may be cut exactly in the opposite direction to what it was at first; we shall perceive by the eye the advantage of this thorough manner of dressing: for that half of the field which had been perfectly tilled before, will have a different aspect, from that which was but carelessly gone over in the usual way: and we shall see plainly, that the one has had the proper advantage of dressings, and the others not. We may find the same proof in the difference of crops on such light land as has been well laboured, and such as has not, but here it is obvious even to the eye.

Many break the particles of a soil with rollers. This does not deserve the name of breaking in comparison of what is done in the proper way by tillage, but it has its advantage. When the land is not too moist, it is a good method of preparing it for tilling; but in wet lands, the roller does more harm than good. Some suppose that they can supply the place of the proper tillage by frequent harrowing of their land after they are sowed; but this scratching of the surface can do little good; and when the ground is wet will do a great deal of harm.

C H A P. XVI.

Of the preparation of wood lands for corn.

WHEN a piece of ground has not been sown for a great many years, and is to be prepared for corn, it requires a particular manner of dressing. This is to be varied according to the condition in which the land has been before; some being heathy, others having lain in wood, some

in pasture, and others in the artificial grasses. These all require their particular methods of dressing; and there are others whose natural humidity makes them demand a method different from all.

In the beginnings of agriculture, wood lands were often dressed for corn. A natural condition of an uncultivated country, is to be over run with wood; and in such case many found whole countries who first set about their improvement. It was not worth while to fell the timber, for they would have had no market for it; so they set fire to it upon the spot, and the ashes, assisted by the action of the heat, were of great service in the improvement of the ground: after this they had no more to do than to stub up the roots; make all level, and go to sowing.

At present wood is valuable, and this land is to be treated in another manner. When a piece of wood ground is to be turned into a corn field, the trees are felled, the roots are stubbed up, and this is such an advantage to the land, that it will answer in some degree the effect of the burning, and of the ashes.

Coppice wood is a good preparation of land for corn; and it may often be worth while to plant coppices with this intent; but whether that be done, or the coppice or larger wood be only felled for this purpose, there is no land that answers more happily for corn.

The holes that are made in taking up the roots, and the rest of the necessary digging, turn up and break the land in an excellent manner, so that half the labour of dressing is saved.

After the earth has been levelled, it is to be turned up once in autumn with the plow, the frosts of the succeeding winter kill the weeds, and break the particles of the soil; and after this no more is needful than a second dressing of the ground in spring: the land may then be sown, and will yield a vast produce.

Land that has lain in wood is not only fertile at first, but it continues so a long time. The trees have drawn their nourishment from great depths, and the upper part has lain in a manner unexhausted, and the shade of the boughs has prevented weeds from growing in any great quantity. Beside this, the leaves falling every year, and lying upon the earth till they rotted, have been a continual manure of the richest kind upon the ground: and the decayed branches have added to the fertility.

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We are to look upon a piece of land that has been some years in wood, as if it had been laid fallow all that time. A good piece of such land, will produce vast crops of corn for many years, without the assistance of manures; dressing it but moderately by the tillage of the horseshoeing husbandry: and that which was originally of little value, and would not have produced corn to any advantage, with the most expensive manures, when it has been laid some years in wood, answers beyond expectation. There are trees of one kind or other that will grow on any ground; and there is a certain and great advantage from them. We see the consequences of that growth in the improvement of the soil, and both may be sufficient to lead many who have lands which they know not how to bring to any value, to try them this way. In recommending this method, we illustrate the practice of horseshoeing husbandry, shewing the truth of those principles on which we have before said it is founded. The roots of plants seek their nourishment near the surface; and trees penetrate for it deeper: this is proved by the readiness of a soil on which trees have long grown, to yield corn: and we see in the practice by which it is prepared for this growth, the great and certain advantage of breaking and dividing the ground: the stubbing and digging in taking up the roots, serves in the place of so much manure to the land. The spade and pick-axe break the lumps and divide the soil, as well as the common instruments recommended in the new husbandry; and the effect is the same; for the land is made fit for the bearing of corn.

C H A P. XVII.

Of the preparation of heathy land for corn.

BY heathy land, we mean waste and useless ground, that produces weeds of the worst sorts, and is barren of what is good: such as tracts of ground over-run with heath, broom, brambles, fern, and the like.

It is proper to burn these useless products upon the spot, which is serviceable, not only because the heat improves the ground, and the cinders serve as manure, but the immediate effect of the fire upon the roots is a great benefit, nothing so perfectly destroying them; nor any other practice so thoroughly ridding the ground of the fear of their after-shooting. As the seeds are consumed, and the roots destroyed, by this practice, there is great reason to believe they will
never

never rise again, and this is of the utmost concern, because they are dreadful enemies to all useful growths.

We have cautioned the farmer, that in burning stubble upon the land, he does not fire his hedges; but a greater care is needful here. In firing the growth of these waste commons, the quantity is so great, that the body of flame is capable of spreading to do vast mischief. The first care must be to know, before the fire is lighted where it will stop.

When a heathy piece of ground is to be fir'd, the right method is to clear away a good space where it is intended to stop, by cutting up the furze: this will stay the progress, though nothing else can. The stuff that is cut up, being dried, will serve to begin the fire, spreading it at the other end of the ground.

A tolerably calm season should be chosen, and the fire watched as it burns. If it any where at the sides threatens to exceed its limits, the method is to dig a little ditch, throwing the earth upon the fire. This will preserve the rest; for earth is a much more sudden and certain quencher of fire than water.

When the stuff is burned, the roots of the furze and heath are to be dug up with a pick-axe. The land is then fit for the common practice of husbandry.

The best season for burning the bushes is autumn, and as soon as some rains have fallen, the ground is to be turned up in large furrows, by a stout plow, it is thus to lie till spring; and then, after another plowing, it should be sown with oats; the second year it is to have three good dressings, turning, cutting, and breaking it well every time; and the third it will be in a condition to bear wheat, without any addition of manure.

The single article of labour, after the first assistance of burning, does the whole business; but this labour must be well performed, and sufficiently repeated: for as the fertility depends on breaking the lumps, they must be well broken, and nothing but this thorough tillage can prevent weeds from taking possession again of the ground. Notwithstanding they have seemed so perfectly destroyed, they will, after several years, recover, to the destruction of all useful growths, if they be not kept down by tillage: but this method if properly attended to, will never fail. The winter turning exposes the roots to the frost, which nips them, and the summer turnings spread them before the sun, which

which burns them up. In general, it is one vast advantage of this kind of husbandry, that no other whatsoever so perfectly destroys weeds of all sorts, and that in all lands.

C H A P. XVIII.

Of the preparation of land for corn, after the artificial grasses.

AS it may be often proper to prepare an indifferent land for corn, by planting it with coppice wood, the same advantage may also be obtained from the artificial grasses that root deep; and from none so much as saintfoin. This penetrates very deep into the ground, and draws very little of its nourishment from near the surface. The planting a piece of ground with coppice, is a kind of fallowing, with respect to the upper part, and the same is the case with these deep-rooted plants.

Many have been surprized to see saintfoin grow successfully upon stony grounds, which have but a very thin coat of soil; but this instance, when well understood, is the greatest proof that can be brought that this grass draws its nourishment deep, and that it will not exhaust the land near the surface, which is the seat of nourishment for corn.

When there is this stony bottom to a thin soil, it is usually loose, flaty, or cracked toward the upper part, where it rises to the bottom of the mould: these cracks and openings, contain mould of the same kind with that above. The saintfoin sends its roots into these crevices, and runs among them to a great depth. From the earth that is lodged in these it obtains its nourishment, and scarce draws any from the thin coat of pure mould above.

These lands when kept constantly in tillage, succeed very ill, because the quantity of soil is so small; for the roots of corn never penetrate among the stones, but the raising saintfoin on them, serves as a kind of fallowing. After this herb has grown seven years on them, which it will very well do, they will yield three good crops of corn, and may then be laid down to saintfoin again.

These deep-rooted grasses are of the same benefit to all soils: some may want the assistance more than others, but they are useful on all: and after great crops, they prepare the land for corn better than almost any other method.

If a piece of rich land be drilled with saintfoin, six gallons of seed being allowed to an acre, and sowed in nine inch

rows, it may be mow'd annually with great crops; a single crop sometimes yielding four pounds an acre. After it has stood thus seven years, the land may be plowed up, and will be so rich, that instead of requiring to be fallowed or dunged for wheat, the farmer will be obliged to sow that upon barley stubble, and to turn in his sheep in spring upon it, to prevent its being too rank.

This may serve as a proof of the vast advantage of preparing land for corn by these artificial grasses; for saintfoin will be not only in full perfection seven years, but would be able to stand much longer; and no fallowing would have prepared the ground for corn so well.

The best method for preparing the land for corn after this growth is, by first sowing it with turneps; and we would have the husbandman go through it in this manner. Let him plow it up in winter with a four-coulter'd plough, and get it in order for sowing of turneps the following season. When they are in growth, let them be well hoed; and let them be afterwards eaten by sheep, upon the ground. This will bring the soil into excellent order for barley, the following spring.

The farmer will often find it answer his purpose, to raise saintfoin upon a piece of ground for a continuance. In this case, when it grows old he must take it up, and sow corn to prepare the ground again. The method we have here directed is the best he can follow for that purpose: when he sows his barley it may be done by drilling, and the saintfoin with it.

The same preparation answers when the land is intended for corn for a longer time. In this case let the husbandman see the ground be very well tilled, otherwise the first crops will be poor. Saintfoin prepares land excellently for corn, but there must be good tillage at the breaking of it up, or else the advantage will not be obtained. Even oats will not grow upon it to profit, without good tillage. Some have sown a broken-up saintfoin ground with white oats, after once plowing: but if the summer prove a dry one there will in this case be no crop at all, and if the season favour ever so much it will be a very poor one.

From these instances, some have been led to dispute whether the artificial grasses do, in reality, enrich land or not: but those who will not follow proper measures, are not to deny the effects that would have ensued if they had. Those who have taken proper care in the succeeding tillage, have

have always found these grasses left the land fit for any produce. This is so plain in fact, that it has been used against the system of earth being the nourishment of all plants.

It has been said, because saintfoin leaves the land rich for wheat, therefore it draws a nourishment different from that of wheat, leaving what would have been drawn by wheat all there : but this we have shewn to be an error.

Some have ventured to say, this deep rooted grass spreads no fibres in the upper surface of the earth : and therefore leaves it unexhausted : this is one great reason ; but they carry it too far, who say this grass sends out no fibres into the upper part at all.

Saintfoin has a single long and large root which penetrates, counting the extreamest fibres at least fifteen foot deep into the ground, and it doubtless draws a great part of its nourishment from great depths. The plant does send out roots into the upper soil, but that is a small part of the ground among which it spreads, and only a proportional share of its nourishment is derived thence ; so that the case being fairly stated, this soil enjoys a kind of fallow, because it affords but a fifteenth part of the nourishment to the growth that is upon it. This is the true state of the case, and they wrong a good cause who would make it otherwise.

We allow therefore that these grasses draw some nourishment from the soil in which corn is to grow, but this is in small quantity, and it is over-ballanced by another consideration, which is the second crop, or after-lease, being eaten by cattle upon the ground. There is a great deal in this, so much, that there is reason, as well as experience, to shew that a piece of ground planted with these artificial grasses, and properly managed in the use of them, and in the tillage afterwards, is left in as good a state by this growth, as if it had been in fallow. The lower parts of the earth indeed are not so fertile as the upper ; so that the roots of these grasses cannot draw such nourishment from them as from the others ; but though this lower earth is not so rich as the upper part, yet being fresh, and never exhausted, it will supply a great deal to the first roots that come there : those of corn never pierce to it, so that the roots of these grasses will have nourishment.

C H A P. XIX.

Of the preparation of land for corn, after common grafs.

COMMON grafs has not this advantage in preparing land for corn, because its roots do not pierce to any depth; but the ground is notwithstanding ready to bear corn in abundance after this growth, provided it be good in its own nature.

One reason why pasture ground retains a richness to support any crop, is, that in plow'd lands the rains wash away a great part of the fine mould; whereas all is retained in those covered with sward, and whatsoever is brought on by accident with it; as the wash from higher grounds, and the mud from the over-flowing of rivers.

For these reasons a good pasture ground is always ready for corn.

The proper season for preparing it for this is in the month of January; and the farmer should take an opportunity to do it after rains, for when the land is well wetted, the turff is tough, and will turn without breaking.

An experienced plowman should be employed; and the eye of the master should be over him, to see he lays the turff flat.

A good plow should be used on this occasion; for without that no art will make the work go on well. If the earth board do not turn it well, a piece of wood must be nailed on it, to take the upper part of the turff as it rises; this will throw it regularly over with the grafs side downward.

The advantage of this is the rotting of the graffy part, which becomes a kind of manure. But this is only the first step toward the preparing the land for corn. It is to be compleated by repeated plowings, and the more it has, proper intervals being allowed between them, the better it will be fitted for the growth of corn.

This breaking of the ground, is what we mean by tillage; and these repeated plowings are called dressings of the land. Many use the same word to express the laying on of manures; here it means only the turning or breaking of the ground.

Every time the earth is turn'd, the particles of it are broken, the more the better; and it is on this principle that plowing of lands that have fed a large sward of grafs, prepares them for corn.

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The nourishment of all vegetables is fine earth, which they imbibe from the surfaces of the little particles among which their roots spread and run. When these roots have taken up all the fine and small mould that lay about the surfaces of those particles where they spread, the soil is said to be exhausted. It may be renewed by the addition of manures, which ferment and divide its parts, or by the action of the plow which breaks them; either way they are broken, and consequently new surfaces are made. These have new earthy particles upon them, ready to be absorbed by the roots of a new crop: therefore a new crop thrives, being sown upon that land.

This is the doctrine of exhausting and refreshing of land; and it is of the breaking it by the plow we speak in this place. It is done in some degree by every plowing, but most perfectly by the best, and most frequently repeated. A slight plowing moves and divides the particles, without breaking many of them; but still this is of service: for where they are separated, though not broken, there is a new surface at the division, and this answers some purpose though 'tis not so much as will be done by better plowing.

In the preparing a common pasture for corn, there must be careful and good plowing, because the ground has lain a great while undisturbed, and the surfaces of its particles have been well drain'd of their nourishment by the grass. These surfaces could not yield nourishment for corn; but when the ground is well turn'd and divided, the particles are broken, new surfaces are formed, which the grass does not now exhaust: the corn finds it improved by the effect of the rotted grass. This agrees with our plan, which is not to prefer one method before another, but to use both.

If any wonder that land shall be refreshed by tillage after repeated crops, as supposing this turning and breaking of the particles, when repeated so often, must come to no more than the turning up the old surfaces again, he errs greatly, for the earth is divisible without end, and no art could bring about what he supposes to happen by accidents: the same surfaces never can appear again in a thousand plowings, because the particles of the earth form every time new combinations; and every new surface answers like the first; all supplying nourishment equally.

Every soil that will bear good grass, will also support corn. Nor does any kind disable the farmer from having recourse to this assistance of tillage, it agrees with all; on
light

light lands two or three additional plowings will answer the same purpose as dunging; and the cost is not more than a fifth part. This is so plain from the trials that have been made, that it is getting into practice in some places, and has obtained the name of double plowing.

If a field prepared for barley in spring, be not sowed with that grain, but plowed on to wheat harvest, the crop of wheat from it will be very great: and when turneps fail one after another by the fly, the ground thus frequently plowed, bears wheat admirably without dung.

People that are slow to take advice, will be led by experience; and this is the most plain imaginable. From this it is evident there will require no assistance to the plow in preparing grass land for corn, only let plowing not be spared. The work sets out with a natural manure, and it will be a great while before the land requires any other: but when it does, let not the fondness for a plowing system deny the use of it.

CHAP. XX.

Of keeping land in heart by tillage.

WE do not recommend tillage only, for keeping land in condition to bear corn, though that has been proposed as possible, and is supported by some experience. Plowing may do this alone, but the assistance of manures will make it answer better. And sometimes one method, and sometimes the other are to be used, according to the circumstances.

We shall now tell him what may be done by this method alone.

As new broken earth is the same thing with fresh earth, provided it be sufficiently broken, there is no question but tillage will supply the place of manure: for it will always break the soil. Light soils, when well broken by tillage, become closer and heavier, because it brings their parts nearer together; and heavy or stiff land is made lighter by it, because the breaking and dividing of this, naturally renders it less tough, that salt being nothing but the too great cohesion of those particles. But to obtain this advantage for either, the tillage must be sufficient: stiff lands half tilled, have large cavities, which is the very fault of too light soils; and an imperfect tillage of a light soil leaves it rough, and very much of the same nature with the half tilled stiff land: both

both being in this condition, full of large pores, which are not proper for the nourishing of plants.

We mean to shew the practical husbandman; who shall in any respect depend on this method, the necessity of sufficient tillage: if he do otherwise he will deceive himself, and perhaps blame that practice which he has not followed.

Light land, supposing it to have been in grass, becomes lighter for an imperfect tillage; the pieces of turff that remain turned under and not broken, make large hollows, and render it worse than it was before the tillage. But when the farmer finds he has hurt it by this method, let him not be dishearten'd, but go on; let him till it more; till all these pieces of turff are broken, and it is altogether fine, and he will then find it answer very fully to his expectations. This kind of land has an advantage over the stiffer sorts, because it is to be tilled with less labour and expence, working easily: and it answers excellently, for it becomes stronger than at first, and is often more profitable to the farmer than land of a better kind, which requires more laborious tillage.

In very light soils crops suffer in dry seasons; and especially after rains have fallen for some months, and these very dry seasons succeed. This accident happens in proportion as they have been imperfectly tilled; and when the due care is taken, not at all.

The large cavities, when the ground is wetted by long rains, are full of water, and that water touching the roots in every part, supplies the plant with nourishment; but when the dry weather follows, and they become empty, the roots do not touch their surfaces, and cannot be nourished, so the plants fade and decline. But good and perfect tillage prevents the earth from having these large cavities, and therefore remedies this evil. The way to bring them to good, is by the beginning with deep, thorough plowings; and the way to keep them in heart is to repeat the same practice.

The effect of frequent tillage is to make the pores numerous and small; they cannot be too numerous, or too small, and therefore the more tillage is allowed, the better. These pores cannot be too small, when made by tillage, because the rest of the earth being light and loose, the roots of the tenderest and finest kinds will make their way; whereas in untilled earth, they may easily be too small, because the earth all about them is hard.

To keep a piece of ground in heart by tillage alone, that should be done frequently and well.

The first plowing in the usual way answers very little purpose, nor does the second do much more good. These, if done with common plows, and in the common manner, cannot so properly be said to be tillage, as to prepare the land for tillage: the third and fourth plowings are done at less expence than these, and they are of much greater benefit: every plowing that is given after these, does more service, and comes at less expence. This is sufficient to recommend the practice to the farmer; and the effect is certain. We see nothing prepares land for wheat in the common way but frequent plowings: and when they come thus easy, why will not the farmer give more of them to his wheat land, that his crop may thrive the better; and give them also in proper quantity to his lands that are prepared for any other seed: they will return the labour with ten-fold increase.

When a land has been put into good condition by manure, nothing assists the effect so much as frequent tillage; a piece of ground prepared with dung, will be exhausted in three years; but let it have double tillage, which is an expence nothing near the price of a new dunging, and it will keep in heart six years; and with more labour longer.

There is no way of managing land to the best advantage, but by the use of both. Manure should be called in when the ground has been long kept in heart only by tillage; and tillage, in this increased degree, should be us'd to preserve and continue the effects of manure. Nothing is so idle as the proposing one against the other: there is no reason the farmer should not use both, for they never interfere with each other. We have shewn him before the nature of soils, the virtues of manures, and now the benefits of repeated tillage, so that he will be able to call in one or other alone, or both jointly, as he shall find most beneficial.

As to the keeping a land in heart by tillage, it is only to be done by allowing it a sufficient quantity of labour: the more the better; there being proper intervals of rest between. A piece of ground may be thus not only kept in heart, but made stronger and better; for the finer land is made by tillage, the richer it will become; the more plants it will support, and the better it will maintain them.

C H A P. XXI.

Of the nature of the improvement by tillage.

THE finer an earth is made by tillage, the more it is enriched by dews, rain and air. These penetrate into every part of a well tilled piece of ground, so that when it comes to be turned again, and fresh broken, all is rich and full of nourishment. This is not the case in tough and hard lands; the dews and rains do not penetrate them.

In very dry and light lands, the instruments of husbandry cannot take full effect, for their particles give way to the plow without dividing, and at the utmost are only turned. The author of the horsehoeing husbandry is aware of this; and he declares, such lands do not deserve the name of arable, but should be reputed desert, scarce deserving the name of land, except by way of distinguishing them from sea.

Were there no other husbandry in the world but the horsehoeing kind, this would be true; and the farmer who happened to have such ground in his hands, must leave it uncultivated. But this may shew the insufficiency of that author's scheme of making the horsehoeing husbandry universal, even from his own confession.

We have shewn how such land, as he says ought not to be called arable, may by another method of husbandry be improved so as to yield large crops: and by such management as we have directed for barren sandy lands, the very deserts of Libya might yield excellent crops of corn.

Clay added to a sandy ground, reduces it to loam, and loam is fertile: furzes may be raised for a fence. In such an inclosure, corn will grow, therefore this new scheme is not universal. It will assist the old methods of husbandry, but it will not supply their place.

We see in this last instance, the land cannot be brought into heart by tillage alone, even upon his own confession; this sort of land then must be managed upon the principles of the old husbandry; that is, by clay, and the proper manures: but it may be kept in heart by tillage.

The method proposed by Mr. Tull, has great advantages, tho' it will not succeed alone. This land will be better kept in heart by his kind of tillage, than by the old, because his is the more perfect. The soil is made less fine in common tillage, therefore the advantage will be less; in that he di-

rects it will be more fine, and consequently, the effect will be greater.

We cannot see a greater instance of the effect of husbandry any way, than on such a piece of land as this. The farmer upon the principles of the old husbandry, adds clay to it, and by this means converting it into loam, he may be said to make a soil. It is then in the condition of one that is better by nature, and is fitted for new improvement by a more perfect tillage. It could not receive the advantage of that method according to the confession of its author in its natural state; but it may in this improved condition. We see therefore how useful it is to the farmer to know every practice; not to stick to any one, but to employ them all as there may be occasion. 'Tis thus we propose them to him for his general use. He sees in this instance he may make a soil by the old methods, and he may keep it in heart by the new; so that the one shall continue to him those advantages he received from the other.

The two great articles in providing plants shall have nourishment, are, that the roots may spread freely to their full extent, and every where have the due pressure of the ground. These are effected excellently by tillage in a complete way, for the earth is made fine and soft: it lets them in any where, and it closes in every part about them. All the earth is full of nourishment for plants, and their roots are thus put into a condition to search for it, and receive it. If they could not spread by reason of the hardness of the ground, they must be content with what is supplied by the earth just about them; and if they spread ever so freely, and pass where there is ever so much nourishment, they cannot get it unless they come to touch the surfaces whereon it lies; this they cannot do in half-tilled ground because the cavities are there so large, that the small roots pass through them without touching their sides. We repeat this that the farmer may perfectly understand and remember it; for this is the principle on which he is to act in the new method of tillage.

Let him never spare tillage: the land being poor is no argument against it: for the poorer the easier it is wrought; so that there is less expence in the tillage; and if the crop be not equal to that upon better land, neither is the rent.

The great mistake of the English farmers, is not giving their land sufficient breaking; and in this they err very unhappily,

happily, for they go through the laborious and expensive part, which is that of the first plowings; and leave off just when the remainder is most wanted, and would be most easy.

They suppose the soil to be fine enough when the harrow will cover the seed: as if the covering of that were the only use of the fineness of land. To give the crop the full benefit of the land, every lump should be broke; for tho' the seed may be buried among these, and covered in an irregular manner, the roots which shoot from it will never be able to penetrate those lumps; and they are of no service to its vegetation; whereas if the tillage had been continued till these lumps were broken, every particle of the soil would have been made useful; and the crop would have had the advantage of double, treble, or sometimes much more land in the same field.

The harrow is an instrument that often misleads the farmer to his hurt. He supposes he can tear the soil to pieces with it; whereas, on the contrary, the horses that draw it often do more harm by their treading, than the harrow does good. Let him never depend upon this instrument for breaking the ground; let him use it sparingly and cautiously, and then it will be of service: but better things may become hurtful by improper management.

The roller is another implement that often does harm, though it may do a great deal of good when properly used. The season is of great importance. The business of tillage is to break the land, and divide its parts; this may be assisted by the roller, if used at a proper season, otherwise it may be impaired by it. If the roller be brought on in wet weather, it presses down and closes the soil; but if used only in dry seasons, it breaks the lumps, and does a great deal of good.

If the harrow be used first to tear up the clods, then the roller to break them, and the ground be afterwards plowed again; and all this in dry weather, no kind of tillage answers better.

BOOK VI. PART III.

Of the Instruments of Husbandry, and their several uses.

C H A P. XXII.

Of plowing.

WE have explained the principles on which tillage is founded, and the means on which its success will depend. This may be called the theory; from which we now come to the practice. Nor would that theory have been allowed so much room, but that the practice depends for its success entirely on the understanding it.

The management of grass grounds is comprized in a small compass; and the expence and hazard are little. But the management of arable land is the height of the farmers business. It requires the most knowledge, and it demands the most expence, therefore he should endeavour by all means to make himself a master of it. The profits arising from this branch, are much greater than from any other; but if he sets about it ignorantly, the loss will be great, and his ruin may be the consequence.

All soils are not to be wrought in one manner: if they were, the knowledge of husbandry would be easy. But as each has its particular manures, so it requires a particular and appropriated manner of tillage. Plowing is the capital operation of husbandry, and according to these differences of soils, and the particular treatment they require, there have been invented different sorts of plows: these are severally used according to the nature of the ground, and shall be described in the succeeding chapters.

There is great difference between a tough clay, and a loose sand: one of these soils requires one and another kind of plow, and of plowing; neither would any use the same instrument to till a deep soil, and one where there is at five or six inches depth a bed of stone. There is often a bed of barren earthy matter also at this slight depth, which is not to be brought up with the soil. These demand their different manners of plowing; and in order to its being rightly done, the farmer is to see there be a proper instrument, and to follow the work with his eye, that it be rightly used: that the
best

best part of the soil be not left untouched where it lies deep; nor the barren part raised up where that lies shallow.

These light and shallow soils work easily, and cost little in tillage; but they are often so poor, that they require a large expence for manures. Tillage alone, as we have said, will make almost any land bear crops; but manure is to be added to these, that the crops may be great.

On the other hand the firm and tougher soils depend more upon tillage than manure. Plowing comes dear in these, but the expence in the other article is so much lessened.

All that has been hitherto said of plowing, regards the time before sowing the land; but we are to mention also under that head, another species of tillage, which is performed after the plants appear: this is, properly speaking, not plowing, but hoeing; though, according to the new method of performing it, by a kind of plow, and with the assistance of horses, it has got the name of plowing. This is the kind of tillage called horsehoeing husbandry: it has its foundation upon very rational principles; and its success answers accordingly; but there is a backwardness of bringing it into use, which seems to arise principally from its novelty. In other countries where they are more ready than we to try experiments, it is got into use, with great advantage. We hope to see it soon introduced in the proper soils, and under proper circumstances, here.

C H A P. XXIII.

Of the form of the antient plow.

WE may see by the plow, that the most useful things are neglected, if common; and those who have it in their power to be of greatest service to the world by improving, least regard them. There is no author of any note who has written on the structure and useful variations of this instrument: nor have men of genius or knowledge concerned themselves in its fabrick. Plows were invented in the rudest times; and, till very lately, they have had little improvement. What has been done, by some few ingenious persons within these few years, shews what is practicable; and we hope will lead others to the same useful pursuit.

The first tillage was probably with the spade, and were that as convenient for large quantities of ground, as it is useful where it can be properly employed, no instrument

could be compared with it. But when whole fields came to be tilled, it was natural to devise some method of saving the labour of men; and, consequently, the plow was invented.

As this was more frequently used, its form became altered, but improvements have been in nothing so slow: and this instrument of such universal use, and so vast advantage and importance to mankind, is still capable of many more; and still wants them.

All tillage has its advantage from dividing the earth. The spade, as it is wrought by hand, does this most perfectly; and for this reason gardens are more fertile than fields: but it may not be impossible now we know in what the perfection of tillage consists, to make the plow equal its effect.

The advantage of the spade is, that it goes deeper, and divides the land into more particles: but the plow, when its structure shall be fully perfected, is capable of all this. The four coultered plow is an excellent contrivance, and shews there is nothing impracticable in the thought of forming one that shall go deeper, and divide the earth more than the spade.

The antient plow had no coulter, nor earth board: the share always going obliquely, served as an earth board; and the two ears which were the corners of a piece of wood lying under the share, did the office of ground wrefts.

This sort of plow is used in Italy, and even in some parts of France at this time. It serves for the turning up of light land, but it would do nothing with our stiff and tough soils.

This appears to have been the original plow, and it is a very plain and simple contrivance. It did the office for which it was made in the place where it was invented; but it was not fit for other lands, and other countries; and therefore it was altered in them.

In those parts of Italy where the soil is soft and mellow, this instrument does very well to keep it in tillage; but even in those favourable lands it is unfit for the bringing them into that condition: for when they have lain in grass, it is difficult to manage them with it. They are obliged to go two or three times over the land before the turf is broken.

These plows, for want of a coulter to cut the turf, tear it to pieces with great awkwardness and difficulty, but when that is once cut through, the soil being soft and tender, they easily get deeper.

As our soil is different, our plows are made in another manner, for otherwise they could not cut it. The necessity of a coulter is plain, because of the thickness to be cut, and that necessity was doubtless the mother of the invention. Our plows, when well made, cut off the furrow at the bottom flatwise, and therefore it is as thick on the land side as on the furrow side; but the plow cannot break it off from the whole land at such a thickness, so that there must be a coulter to cut it. By this means the furrow is turned perfectly whole, and no part of the turf broken. Hence if it lie long without new turning, the grass from the edges will spread, and form a new turf on the other side, which was the bottom of the furrow, but is now the surface of the earth.

If the land be left thus, it will soon be greener than it was before plowing, and the grass spreading its roots, will bind it firmly together; so that there will require a great deal of time and labour to bring it into a condition for service.

This has shewn the insufficiency of the common plow, and from a sense of this, has arisen the invention of the four coultered kind. Several others have been devised to answer the same purpose, but none succeed so well,

C H A P. XXIV.

Of the several kinds of plows in common use in England.

OUR common plow differs very much in shape and form in various places; according to the fancy of the people, and the nature of the ground. Some have longer and some shorter beams; and there are great varieties in the length and form of the share, the coulter, and the handles.

Without regarding the customs of particular places, there is great reason to have respect to the nature of the soil. The plow for stiff clay should be long, large, and broad, with a deep head, and square earth board, so that it may turn up a large furrow. The coulter should be long, and very little bending, with a very large wing; and the foot long and broad, so as to make a deep furrow.

The plow for moderate soils should be smaller than the former, but broad at the breech: the coulter should be long and more bending, and the share narrow, with a wing

wing coming up to arm and defend the earth board from wearing.

The plow for light soils, should be lighter and smaller than any of these: the coulter should be more circular and thinner, and the wing not so large.

This will give the farmer the general rule for his conduct: let him consider his soils under these three heads of heavy, moderate, and light, and in this general manner suit the Bulk and fabrick of this instrument to them.

Plows are sometimes made with wheels, and sometimes without, but in general the wheels are a great advantage. There are circumstances in which they are troublesome, and therefore it is fit they should be in some plows omitted.

That which might be esteemed the first great improvement in England, is the wheel plow, which from the place where it was first us'd has been long call'd the Hertfordshire plow. This consists of a beam and handle, a neck, an earth board, a sheath, a share, and a coulter, with the pin, pillow, and wheels. These are parts exceeding familiar to the farmer, but for the sake of those, who may not be acquainted with the practical part of husbandry, they will be explained in the figures; in which we shall also shew how this plow is form'd, as improved at present.

This common wheel plow, as usually made, is very strong, and is serviceable for most uses. It is easily managed, it follows the horse lightly, and it suits almost every kind of land. The greatest exception to its use is in miry clays in winter; because the wheels cut into them, and clog and stick when they are work'd at that time of the year. This is fit for that sort of ground when summer fallows are to be plow'd, and when a grass ground is to be first wrought for arable, for it turns the turf well, and is very fit for uneven ground, and for the driest summer weather. Some make this plow in the original manner, with the handle sloping on one side, but this renders it troublesome to hold, or to follow; the remedy was easy, and people not bigotted to customs, have improved it greatly by making that part strait.

This is in a manner the general plow at this time, and it is thus varied more or less, but never much, according to the pleasure of the owner, or fashion of the place, that we shall always mean when we say the common plow.

The Essex plow, (for the best way to distinguish these instruments is according to the places where they are used)

has

has its earth board, if the expression may be allowed, made of iron: they make it rounding, and this has a great advantage in the turning the turf, they generally make it light, and the wheels proportioned. It is fit for light soils, and rids a great deal of business. We do not mean by calling this the Essex plow, that they use no other in that county; but that is the place where this kind is most used.

The Lincolnshire plow owes its form to the general nature of the soil in that county. The fen land there is light, soft, and mellow, free from stones, and naturally over-grown with weeds and sedge on the surface: for this they use a plow with a circular turning coulter, and a large sharp share, this is often a foot broad, and quite sharp at the edge. This plow has no wheels. There is a foot at the fore part of the beam, which they set higher or lower with a wedge, and by that means keep the fore part from going deeper than they chuse. They have also wedges for setting the hinder part where the handle joins the beam. The coulter stands in its usual place, before the share, and is a round iron wheel, with a sharp edge. This turns upon an axle as the plow moves, and cuts through the roots of the sedge or grass as it goes round, while the broad share cuts the bottom. This would not do on other land; but where the soil is of a free and fine kind, and is thus cover'd with a tough and tangled matting of roots, it answers the purpose excellently.

The dray or drag plow was at one time, in a manner, universal, and there is no particular place where it can be said to be most in use now. It is retained in some, and rejected in others, according to the sense and spirit of the farmer in adopting improvements. This is a very plain and simple kind; but notwithstanding the advantage the others have over it, on many occasions, it excels them all for wet clays in the winter plowings; for having the least workmanship of any, it is the least apt to clog, and having the fewest parts is fittest for such ground, where nothing is requir'd but going on, and turning up. On other soils, and at other seasons, it is much inferior to the other kind. This plow has no wheels: it consists of a beam, handle, earth-board, and share, and is set higher or lower, as they find occasion, by wedges at the sheath.

In Suffex they have a plow with one wheel: this is a very ill contrived, and inconvenient instrument. 'Tis broad in the breech, and therefore draws heavily. It is growing out

of

of use there: and of all the plows that have been invented, is the least worth introducing any where else.

The largest kind of plow, is that which in some parts of the county of Cambridge, they use for cutting of drains. It is of the shape of the common plow, and has no wheels; it is very bulky in all its parts, and has two coulter; one of these is fixed in the beam as usual, and the other in a piece of wood, fastened to the beam for that purpose; these both turn inwards, and cut each side of the trench. The share is broad and flat, and cuts the bottom of the trench. The earth board is three times as long as in other plows, and casts the mould a great way off the trench. This instrument cuts a trench a foot and half wide at the top, a foot at the bottom, and a foot deep. It is excellent for this purpose on wet lands, saving a great deal of expence in the common way of digging trenches by hand, but it requires a number of horses to draw it. There is something in the contrivance of this plow, that may be useful farther than in the making of trenches, and it is for that reason proposed here to the farmer's consideration.

C H A P. XXV.

Of the uses of the common plows, and their proper make.

WHERE there is a hard soil; or where the land is full of flints, sharp stones, and gravel, no plow does so well as the two wheel'd kind: this may be suited to the occasion, with respect to strength; and where strong clays are to be wrought in summer fallows, no other is equal to it. The point of the common plow will fly out at every step on these occasions, but this will answer very well when the earth is so hardened, that no other will penetrate. The wheels of this plow should be about twenty inches in diameter, and it will always run best if the furrow wheel be made a little larger than the other.

A great advantage of this kind is, that it will work upon uneven ground without levelling, so that none is equal to it for the plowing up of pastures where there are mole hills. These disturb the other plow extreamly, but this goes through all.

Though the single wheel plow of Suffex be so clumsy an implement, there is no reason why the use of a plow with one wheel should be rejected. A light and slender kind may be furnished with one wheel instead of two, and will answer

swer excellently on light sandy soils. It will not be fit for harder work; but running easily it will serve this purpose better than any other.

The common two wheel'd plow is to be drawn with horses or oxen two a-breast. The heavy plow without wheels, which is useful for wet clays, and other disagreeable work, is to be drawn by three, four, or five horses in length. The great use of this is where the ground lies level, and where there are no obstructions of roots, for these greatly disturb its operation. The two wheel plow is preferable in such cases, notwithstanding all its inconveniences.

Whichever of these plows the husbandman chuses, let him take care in the make of it, that it be suited to the soil. Let it be made larger if for deep or strong soils; and lighter and smaller if for shallow ones. When the land is stiff and deep let the coulter be long and strong; in the deepest soils the coulter must go farthest, because the weeds root deepest there.

Of whatever form or strength it be, let him see that the iron work be made true as well as sound.

As so much depends upon the iron work, it is best to have that made first, and the wood work wrought to it: for in the common way of making the iron to the wood the smith is often forc'd to work wrong in order to suit it: and then no art will make the plow go well. Let him take care the iron work be wrought smooth, and rightly temper'd; and let it be kept bright and clean in the using.

The shorter and less the plow, the easier it is worked; but though this be a recommendation in light soils, there is no using such as have not a due weight and strength in tough and heavy work.

CH A P. XXVI.

Of the improvements of the common plow.

THE regard shewn to husbandry of late years, has occasioned some amendment of the plow, for particular purposes, and several forms have been invented, some rather fanciful than advantageous, others useful.

A double plow invented some years ago, is at this time in use in some places, by which twice the quantity of land is plowed at a time, one furrow by the side of another. As this requires twice the number of horses and of men, the expence is nearly equal to the advantage: but it is a hint capable

capable of improvement, for although in rough and deep soils it loses the benefit, from the necessity of a double expence, yet certainly in some of those light and shallow lands we have in Buckinghamshire, and other places, a double plow might be so contriv'd, as to be drawn by two horses, and managed by one man; and then the advantage would be double, and the expence the same. This has not been put in practice yet, but from what I have seen, I am very certain it is practicable.

There has also been a contrivance of a plow that turned up two furrows at once one under another. This I have seen used, but it is so unwieldy, and difficult of draught, that in the present form it will never get into reputation; but we have seen what would be the advantage of plowing deeper than ordinary, and that is enough to spirit up some who understand more of the mechanic arts to contrive one upon the same plan with more judgment. Doubtless it is possible to obtain this advantage with less trouble than attends it in the plow that has hitherto been contrived for that purpose.

Digging with the spade is a finer and more excellent tillage than that by the plow; and that is the reason gardens are more fertile than fields of the same soil, and with the same manure. That the spade digs deeper, and breaks the particles of earth finer. A plow constructed upon this plan, with judgment, would have both those advantages: it would dig as deep as the spade, and might be made to break the earth as much. It is surely worth the while of those who have a knowledge in the proper arts, to devote some of their studies to this improvement. The adding breadth to the fin of the drag or foot plow, will make it more serviceable in damp and stiff clayey lands; and in plowing these the horses should always go at length, that they may tread less of the ground. On the other hand, in light soils, the cattle should go a-breast, for the double treading is serviceable to such soils. In stony ground with grass of some standing, the plow should have a round pointed share, with a fin to cut the roots.

In ground that has been wood, or in other places where there are large roots in the way, it is a good method they use in some parts of Staffordshire, of having an instrument of iron with a sharp edge, let through the beam of the plow, behind the coulter, and through the plow-head. This while it arms the plow for cutting these roots, strengthens the

whole, and makes it able to bear the rough work, which else would tear it to pieces: in other places they use a couple of sharp wings of iron made fast to the plow-share, which answer the same purpose, but this does not so strengthen the plow. Dr. Plot, in his history of that county, describes these; they are in use still, but not generally. These may all give useful hints, for there is not one of them but has its use, nor one that may not be greatly improv'd.

These improvements rather shew what may be done, than execute it well in themselves; they may be considered as attempts to what is proper, rather than as compleat things: there remains one to be spoken of in which the improvement is very great, and is carried to a due degree of perfection: this is the four coulter'd plow, so highly and so justly extolled by the author of horsehoeing husbandry.

C H A P. XXVII.

Of the wheel plow.

THE foundation of this instrument is the two wheel'd plow, in its most improved condition: it differs in having three additional coulters. We shall first consider this wheel plow in its improved state; and afterwards the four coulter'd plow formed upon it. This consists of two parts, distinguish'd by the names of the plow-head and plow-tail. The head has two wheels of about eighteen inches diameter: the spindle or axis of these is of iron, and passes through a box which stands crosswise of the beam. This spindle turns round both in the box and in the wheels. From the box rise two perpendicular staves, called crow staves: these are fastened into the box, and have each two rows of holes, by means of which the beam is raised or sunk, in order to increase or diminish the depth of the furrow. This is done by pinning higher or lower a cross piece, called the pillow, because the plow beam rests upon it. At the top of the two crow staves is another cross piece, called the gallows. The crow staves pass through this by mortises, and are pinned into it. From the box of the plow within the staves, there is carried a small frame composed of two legs, and a cross top, to which the links of iron are fixed whereby the plow is drawn: this frame is called the wilds of the plow. In the middle of the box there also is a hole into which is let one end of an iron chain, the other end whereof is fastened to the middle of the beam, this is called
the

the tow chain, and fastens the head and tail of the plow together: at the end where it reaches the beam, this has a collar that goes round it, and is fasten'd by a stake within side the box. This stake is held up to the left crow-staff by a wyth, which passes round it above, and under the end of the gallows below: a piece of cord is sometimes used instead of a wyth: any thing that may be tied will do. From the top of this stake goes an iron chain, called the bridle chain; this is fasten'd at one end to the top of the stake, and at the other to the middle of the beam of the plow, by a pin in the same place where the collar of the tow chain passes round it.

This is the structure of the head of the plow; and these are its parts.

The tail consists of the beam, which is a stout and long pole; through which, a little below the pin that holds the bridle chain, and the collar of the tow chain, there passes the coulter, a long and slender iron instrument, which running downward and a little forward, ends near the point of the share. The coulter is fixed in its hole of the beam by a wedge, so that it can be raised or sunk at pleasure: behind are two handles, one longer and the other shorter; the shorter of which meets the head of the fore sheet, where it enters the beam, and is fix'd by a pin, and fasten'd to the top of the hinder sheet by another pin. These sheets are two boards, the hinder one near the extremity of the beam; the other forwarder and more slanting; and are both fasten'd to the share, which runs flat below. On the other side of the plow tail descends another flat board, call'd the drock; to this the groundwrist is fastened, which is a board running nearly parallel with the share. The longer of the two handles is also fasten'd to the drock, and the earth board rises at its bottom. The fore sheet is supported by a double retch, which passes through the beam, and is fasten'd by screws and nuts.

This is the four wheel plow as used at present where agriculture is most understood, and best practised: it consists of more parts than the two wheeled plow of Hertfordshire, according to the first invention, but there is not one of these but is an advantage in either strength or convenience.

CHAP. XXVIII.

Of the four coultered plow.

WE have seen the two wheeled plow formed upon the best model, and in the most artful manner that has been yet devised for it. And we are now to give an account of that great improvement upon the four coultered plow. This, as it adds parts of the utmost use, may be consider'd as a distinct instrument, its three additional coulters giving it a power of breaking the land beyond any other that ever has been invented.

The reader, who is acquainted with the structure of the two wheel'd plow, will find no difficulty in comprehending this.

The beam of the common two wheel plow, is usually eight foot long; the proper length of the beam of the four coulter'd plow, is ten feet four inches. That of the common kind is strait all the way, but that of the four coulter'd plow rises with a bend when it comes toward the wheels, to where it rests upon the pillow. The beam, supposing the plow to stand upon a level surface, would be at the end of the tail only eleven inches and a half from the ground: at the place where the bend begins, which is a little before the first coulters, it will be one foot eight inches and a half; and where the beam bears upon the pillow, two foot ten inches.

The four coulters are thus disposed. Measuring from the tail or extreame end of the beam behind to the back of the first coulters, is three foot two inches; this has its point near the share. From the back of the first, to the back of the next coulters, is thirteen inches, from thence to the third thirteen inches, and from thence to the fourth the same. So that from the end of the beam behind, to the place where it begins to bend upwards, which is a little before the fourth coulters, counting from the tail, is seven foot. The length of the additional coulters, particularly of the fourth, next the head of the plow, would be a great inconvenience in this machine; but this is prevented by the bending of the beam toward the head. If the beam were strait as in other plows, these coulters must be very long to reach the ground, and they will require to be extremely strong not to bend: this would make them expensive and cumbersome; and at the same time their length, if ever so

well form'd, would make them apt to loosen the wedges wherewith they are fix'd in the holes. This would make the coulter rise up out of its work : but by the contrivance of a crooked beam, a moderate length in the coulters serves ; they do not require any great thickness or quantity of iron, and they always work with regularity.

The beam may be made of ash or oak, according to the nature of the ground whereon it is to be employed ; for ash has the advantage of being light, but the oak is vastly stronger : when the work will be very hard, the oak in spite of its weight, is preferable. As to its breadth and thickness, they may also vary according to the soil that is to be tilled ; but for moderate ground, the beam at the first coulter hole should be five inches deep and four broad.

Giving this as a middling proportion, the size of the other parts may be as follows. The fore sheat, commonly called simply the sheat, should be seven inches broad ; the retch upon it must be of iron, and its left leg must stand foremost, that the edge of its forepart which is flat, may fit close to the wood of the sheat. The use of this reach is to hold the sheet up to the beam, by means of nuts and screws. Through the top part of the sheat there is also to be a hole, which is to be a small part within the beam, so that a pin being driven into the hole, draws up the sheat very close. The elevation of this sheat is a great article in the management of every wheel plow. If this make an angle of more than five and forty degrees, with the plain surface whereon the plow stands, that instrument will never go well. In the four coulter plow it ought to make an angle of forty-two or forty-three degrees only.

This will be very well understood by those who are used to mechanics ; but for the sake of the common farmer, we shall say all that is meant by it is, that the sheat is to be a little less raised in this than it is in a well going common wheel plow.

The length of the share from the point to the tail, should be three foot nine inches. The fin of the share rising slanting from the point upwards. The point of the share should be three inches and a half long ; it should be flat underneath, and round at the top, and this should be of hard steel underneath. The edges of the fin also should be well steeled, and its length proportioned to the nature of the ground.

Behind the fin is placed the socket, into which the bottom

tom of the sheat enters; and from the tail of the share is to rise a small plate of iron: this is to be well rivetted to the share. By this the tail of the share is fastened to the hinder sheat. This fastening is done by an iron pin with a screw at the end, to which a nut is to be screwed on the inner side of the sheat.

The socket is to be a mortise of about a foot long, at the upper part two inches deep; and the fore end must not be perpendicular, but slanting, conformable to the fore part of the sheat. The upper edge of the fore part of the mortise must bear against the sheat; and if it be not quite so slanting as the sheat, a little of the wood is to be pared off at the edge to make it fit.

The upper side of the share should be perfectly strait, but its neck on the under side should stand a little hollow. This hollowness should be about half an inch in a common plow, but in the four coulter'd plow it should not be above a quarter of an inch: so that the share, when it is first made standing upon its bottom, bears upon the level surface only in three places; the point, the tail, and the corner of the fin. The hollowness of the fin must be greater for a stony soil than others.

The placing the share rightly upon the sheat, is the most important and most difficult part of the plowright's trade: on this depends the well going of the plow; and for this reason, as it is more important in the four coulter'd plow than in any other, we advise the farmer when he has made himself a master by these figures and descriptions of the form and structure of this plow, to take care that he employ a skilful and an honest workman: and if he do not find the plow go well when made, to look there for the occasion of the fault, for in that part is generally the seat of it.

The groundwrist is to be of iron, its length must be two foot five inches, its breadth at the longest end four inches, and it is to go somewhat smaller all the way. Its thickness in general is to be three eighths of an inch; but at the smaller end it is to be much thinner, that it may be capable of bending so, that it can be brought close to the share.

At the smaller end of the groundwrist are to be four holes, through one of which there goes a nail that fastens the groundwrist to the sheat. This passes through a long hole which is made in the side of the socket of the share. The space between the outside of the groundwrist, to the outside of the share, is eleven inches and a half, and this is the

width of the lower part of the plow-tail at the ground. At the upper side of the broad end of the groundwrist there are also several holes, by which it is nail'd to the lower part of the drock, this is long and narrow, and has three holes for the reception of its fastenings.

The earth board has a rising near its end, which takes hold of the end of the sheat to fasten it the more firmly; and near that are two holes by which it is fix'd to the sheat: at the other end also there is a hole by which it is fasten'd to the drock.

The pin which fastens the earth board to the drock, is to be thicker in the middle than at the end, and this prevents the earth board from coming near the drock. By means of this pin the earth board is also set at a greater or smaller distance from the drock, as there is occasion sometimes to throw off the furrow farther from the plow than at others. It always stands a good deal farther out on the right hand than the groundwrist, and this is one reason why the drock is made crooked; bending outwards in that part.

The long handle of the plow is to be five foot four inches in length, and four inches broad in the widest part. It is to have holes in its lower part for pinning it to the sheat, and another near its upper end by which it is fasten'd to the drock.

The length of the short handle is to be three foot nine inches, and it is to have two holes, both toward its lower end: by the upper hole it is pinned to the hinder sheat, and by the lower to the top of the fore sheat above the beam.

We come now to describe the placing of the four coulter in the beam, contriv'd for their reception; this is the most important article of all: the greatest point to be obtain'd is, that the four imaginary planes, described by the edges of the four coulters, as the plow moves forwards, be all parallel or nearly so, for if this be not regarded, they will not enter the ground together.

To make sure of this important point, the holes for the coulters must be made in the beam in the following manner. The first couler is to be placed as already directed, the second couler hole is to be made two inches and a half more on the right hand than the first: the third two inches and a half more on the right hand than the second; and the fourth two inches and a half more on the right hand than the third. This will place the four coulters conformable to the four cuts they are to make in a ten inch furrow.

No beam of a plow is broad enough to hold these holes in this direction ; and for that reason a piece of wood is added to the beam of the four coultered plow to give space for it. This piece is to be very well fastened to the beam : the second hole is to be made, as will be seen, according to the distance, partly in the piece, and partly in the beam ; and the others will be all made entirely in the piece. The piece is best fastened by three good screws with their nuts, and its place is on the right side of the beam. The distance of each hole to the right of the last, must be measured from the middle of one hole to the middle of the other.

The fore part of every hole must incline a little to the left, so that the backs of the coulters may not bear against the left side of the incisions made by the edges. Each hole is to be a mortise of an inch and quarter wide, with its two opposite sides parallel from top to bottom. The length at the top is three inches and a half, and at the bottom three inches : and the back of each is not perpendicular but slanting, and makes the coulters stand slanting. It is fixed in this mortise by a wedge in the same manner as the coulters are in other plows.

The coulters are a kind of iron knife, consisting of a handle and blade ; the latter having an edge. The length of the coulters is to be two foot eight inches, but it will shorten in wearing ; the blade is to be sixteen inches long, with its edge running all the way ; the handle is to be of the same length. This is so long that it will at first very well stand up above the beam, but it must be driven down lower and lower, as the point shortens by wearing. The handle is to be an inch and seven-eighths broad and seven-eighths of an inch thick throughout.

The first coulters in all plows should be so placed, that its back should bear against the back of the hole ; its right side above to bear against the upper edge of the hole, and its left side to bear against the lower edge : and for this reason there always are required at least three wedges to hold a coulters in its place. The pole wedge stands before it, the other two, one on the left side above, and the other on the right side underneath : and the hole must be so made, that the coulters standing thus across, its point may incline two inches and a half or more toward the left than the point of the share, if it were driven down as low as it : but it should never be so low in any plow whatsoever. As to its bearing forwards, the point of the coulters should never be be-

fore the middle of the point of the share. It must be set obliquely with respect to the share; as we have disposed it in the figure of the wheel plow, and it must never be set much more slanting; for if it should, it would have greater force to raise up the pole wedge, and would be continually getting loose.

The three other coulter are to stand in the same posture with this in respect of the inclination of their points to the left. This is a great advantage to them; for by that means when the fin is raised up by turning the handles toward the left, their points do not rise out of the ground on the right hand as they otherwise would. With respect to their pointing forwards, experience shews, that every one of the three should be set a little more perpendicular than the next behind it; so that the fourth coulter will stand nearest to perpendicular of any of them.

None of the coulters ought to descend so low as the bottom of the share, unless when the plowing is very shallow. It is always sufficient that they cut through the turf, however deep the plow go into the ground.

When the plowing is to be very shallow, the fin of the share should be broad enough to cut off the fourth piece of the furrow.

The nut which serves for fastening the piece to the beam of the plow should have two opposite corners turned up, by which it may be driven round with a hammer. This has so great a force, that three of these will hold the beam and the piece as firmly together, as if they were one bit of wood. In dry weather the wood will shrink, and then the nuts are to be driven farther on. The same caution must be observed in other parts of the plow. Between the nut and the wood there should be a thin piece of iron by way of bolster: this prevents the nut from wearing into the wood, it must be somewhat larger than the nut, and of the thickness of a shilling. Some use a piece of leather, but when the nut is to be often screw'd, iron is much better.

There must also be iron plates upon all the coulter holes both above and below. These must be nailed on with nails made for that purpose.

Instead of a collar moving round the beam, 'tis much better to have a square one with an open end, which shall fasten to it by a couple of crooks. These must turn upwards, that they may not lay hold of any thing that shall be turned up under the plow; the front or close end of this collar

collar is to be a strong iron bar, with several notches. Two pins are to be driven into the beam, just behind the second coultter hole, one on each side: and there is to be another crook called a (C) from its shape, which is go over the close end of the collar. Each end of this is a hook, and one of these lays hold of the cross bar of the collar going into one of its notches; and to the other is fixed a link, which holds the tow chain to the collar.

The use of those notches, and this fix'd position of the collar is this; that as the share wears at the point, it always inclines a little to the right; and this is remedy'd by removing the crook into another notch of the cross bar of the collar, so that the point of the share is thus always kept in a proper direction. The length of each side bar of the collar should be a foot.

We have shewn that the tow chain of the plow is fasten'd within the box by a staff pass'd through its first link, as the hook of the collar holds its last. This stake is commonly nailed to prevent its flying out of its place. When the plow is to be drawn a little nearer the crow staves, the method is to take in another link of this chain, passing through the stake, and fastening it as before: or it may be done better by taking hold of the crook of the collar, with a second or third link of the chain. This shortening of the chain draws the point of the share to the left.

For drawing of the plow there is fasten'd to the box an iron machine, called the wilds; this is very like the square collar, only its legs are longer. The cross bar at the top is notch'd, but only one leg of the wild are fix'd to this square bar in the making: the other leg is loose, and has a loop through which the other end of the cross bar is put, so that it is fixed on at pleasure. Both these legs of the wilds pass through the box of the plow, and are fastened in behind it by a couple of hooked pins. The holes cut through the box for letting these legs pass are to be made slanting upwards, so that the fore parts of the wilds may be higher than the hinder; otherwise the upper end of the crow staves will lean quite back when the plow is drawn. The use of the notches in the bar of the wilds, is to give the plow a broader or a narrower furrow. A double crook with a link is fix'd to this bar, and by this the horses draw. If these cattle are tall, the traces must be long, else they will be apt to raise the wheels off the ground, and overturn the plow.

The legs of the wilds should be eight inches and a half a-

sunder, and their length should be nineteen inches: the links are to be six inches and a half long. They are to be put into two notches distant from one another, or else one wheel of the plow will advance before the other. When they are moved to the notches on the right hand, it brings the wheels toward the left hand, which gives the greater furrow; and on the contrary, when they are moved on the notches on the left hand, it gives the plow a less furrow, by bringing the wheels toward the right.

The height of the wheels we have mention'd already, as also the proper method of making one of them higher than the other: their distance should be two foot five inches and a half, as set from one another on the ground. The crow staves should be one foot eleven inches from the box of the plow to the gallows that goes across them: these are to stand upright upon the box, and they should be ten inches and a half asunder.

The pillow which crosses the staves below the gallows, is to be pinned up at its end by two small iron pins, and it is convenient to keep these chained to it, that if they chance to drop they may not be lost.

The height from the ground to the hole in the box where the tow chain passes through, is to be thirteen inches. This brings it to two inches below the holes of the wilds, on the hinder side of the box.

The height of the plow at the place where the other end of the tow chain is fastened to the beam, should be twenty inches from the level ground; and about the middle of the tow chain there should be a swivel, that one end of the chain may turn without the other.

This is the construction of the four coulter'd plow; and as it is founded upon the two wheeled plow improved to the greatest perfection, the parts of that plow can never be so well understood as in the description here given for their perfect and exact construction. We have taken this opportunity of entering into the full and exact detail of them; and we have formed the figures relative thereto. It is necessary that he who would undertake to make or to give orders for the making of a four coulter'd plow, should understand the construction, parts, and composition of a perfect one with a single coulter; and we have by this means avoided the repetition of a long and dry detail of the parts.

When the four coulter'd plow is made, let it be try'd with the single coulters before the others are put on. There may

may be a fault in the work that cannot be discover'd, even by a judicious eye, till it is try'd; and this may prevent its going as it ought. That plow which will not go well with one coulter, certainly would not with four.

If the plow goes well with one coulter, then put in the other three; there is not much fear but it will also go well with them all. If it do not, then let the position of the three additional coulters be examined; and let it be seen in what that differs from the rule, laid down here for that purpose. That it differs in something need not be doubted; for if they be disposed according to these directions, the plow will go well.

To know whether a plow goes well, examine the furrow: if that be of an equal depth on the right hand and on the left; and if the plow turns it off fairly, it is right. If in the going of the plow, the tail of the share, and the bottom of the drock bear against the bottom of the furrow; and if it goes easy in the hand of the holder, without pressing one arm more than the other, the farmer may be assured it is a good one. Such a plow will go with four coulters as well as one.

C H A P. XXIX.

Of the management of a plow in working.

WHEN the farmer has his plow well made, let him see that he keep it in order; and employ a man who is able to manage it, and who has honesty enough to take the necessary care: the farmer depends more upon the integrity and knowledge of his plowman, than on the qualities of any other servant.

The handles of the plow being made of that length we have ordered, are useful for the proper guiding of that instrument; but often the plowman will cut them shorter to favour his idleness. When they are shortened, he can bear his whole weight upon them, and in a manner ride instead of walking. If he should play this idle trick with long handles, his weight would tilt up the fore end of the beam, and raise the share out of the ground. The keeping the arms long therefore prevents this, and at the same time gives him an opportunity of fairly managing the plow to the greatest advantage.

An awkward plowman will often over set the two wheel-ed plow; but a careful person hardly ever meets with such

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an accident. The great danger is, at the going out at the land's end, from one furrow to another. But the skilful plowman lifts his plow a little round, and then holds up the crow staves with the end of the beam, by pressing his hand hard against the handle, while the plow lies down on one side; till the horses, the wheels, and the body of the plow come nearly to a line in the beginning of the furrow: then he lifts up the plow and goes on.

These little contrivances are very useful. They are more easily seen in the practice, than taught by words; but thus much may let the farmer know when his plowman manages his business right, and when he does not; and assist him in the giving one that is willing directions.

In the use of the four coultered plow, sometimes the first or left furrow is apt to come through betwixt the first coulter and the sheat, and in this case it falls upon the left hand side of the plow.

This, tho' not of much consequence, yet is worth preventing, and the remedy is easy. Let the second coulter stand a little higher than the third; and then the second furrow holding the first at its bottom, will carry it over together with itself, and throw it on the right side of the earth board.

In this placing the coulter, let the farmer never set it so high that it does not cut the turf through. As to the first coulter, tho' it should cut but an inch or two within the ground, the share will break off the first furrow in raising it up.

If in working the coulters become clogged with pieces of the turf, a boy should go by the side with a forked stick to clean them off.

The coulters being disposed as we have described, will have more space between them above than below; so that this clogging will not happen often, and when it does, the cleaning is easily performed. The farmer may know when he shall want a boy to follow for this purpose, because it rises not from the fault of the plow, but the nature of the ground. This in clear ground goes as free and as clean as any; but when there is a great quantity of couch grass, its roots hold the turf together, so that it rises in pieces, and hangs between.

In the common two wheel plow there is a great inconvenience, which is, the leaving a great part of the land unturned, from the share's point going too much to the left.

The consequence is, that the work is done irregularly, and often a great part of the ground which is covered by the broken earth is whole and untouched, and the weeds are found afterwards growing upon it.

Sometimes he will find it happen from the imperfection of the plow, and then he is to apply to the maker of it. The well going of a plow principally depends on the placing of the share rightly upon the sheat; it matters not that the maker can tell him, or shew him that it is right as it stands upon the ground, let him try it in some work, and never be satisfied till it answers its expectation.

This fault, though it sometimes is owing to the make of the plow, may also rise only from the folly of the plowman's setting: it is so that the point of the share turns too much to the left: in this case it will always cut crossly, and leave a part of the ground untouch'd, tho' cover'd by that which has been cut, and is thrown over it.

There is no part of his business which the farmer is more under a necessity of following with his own eye: his interest is engaged, tho' the servants is not. It is easy to plow too shallow or too deep. Where there is a full soil, the deeper the plow cuts the deeper; but where the soil is shallow, and the bottom bad, let care be taken that the clay or whatever other bad matter it be, shall not be turned up with the soil.

When a land lies upon the descent of a hill, let it never be plowed strait up and down, but crosswise. This has a double advantage: the horses are not tired, as they would be with going strait up and down, and the land also will fare a great deal the better.

Grounds upon the sides of hills are poorer than others, and require a great deal of manure; and that is soon washed away from them by the rains, together with the finest part of their mould.

As the farmer would wish these grounds should retain all the richness that he is able to give them, there is no method by which he can better stop the progress of this mischief which exhausts them, or keep their rich parts in them better than this of cross plowing.

C H A P. XXX.

Of the advantage of plowing cross wise on billy grounds.

THAT the rich particles are dislodged by the rains, and carry'd away with them is plain, for the waters runs off

off foul and thick. It carries off the lightest and finest part. This is what it can most easily dislodge out of the rest; and hold up longest. This is what should supply the plants with nourishment.

This is dislodged by rains most of all when the earth has been lately plowed; and in the method of plowing strait up and down, where the farmer cuts so many trenches, for the giving it a clear and speedy passage.

It should be his business to stop and detain this rain water, which has taken up the riches of his soil; but this way he assists its speedy running off. It is his misfortune that the rains have dislodged the fine earth from among the rest, and yet he not only lets it go off, but in the very plowing cuts it a multitude of passages. It is on the contrary his business to stop and detain it; because the longer it stays the more it settles, and leaves more of this fine matter upon the land.

In the common way, the fine matter wash'd out of the field, and according to the course of the descent, and the nature of the fence, it runs to another man's ground, or to some other ground of the farmer's, which does not want it; or it stops in the ditch and there lodges, feeding weeds.

This is the consequence of plowing strait up and down in hilly grounds, which is yet practised in some places, even in the most steep; and almost every where when the descent is small. Where they plow cross-wise, it has been to spare the labour of their horses, more than with any other view: but there is a much more important reason.

Rains fall equally upon the ground, whatever be the manner of dressing it, but their effect will be different according to that method. Let us suppose an upland field of a light soil plow'd cross-wise, and well wash'd by a shower. The water is thick and yellow, being full of the richness of the soil; and it is for running down according to its natural course. It is stopp'd at every furrow. Very little of it gets out of the field. And the whole soil is better and more perfectly moistened by the rain, than it could have been any other way: the fine part which has been wash'd from the surface, penetrating with the water, becomes mix'd with every portion of the mould.

This is a great advantage, and without any other consideration, ought to influence the farmer never to plow any other way on these lands. Reason should get the better of prejudice, but nothing should get the better of experience. Reason never contradicts experience: where the fact is
rightly

rightly stated, they always enforce and confirm one another.

C H A. P. XXXI.

Of laying land in ridges.

A Great article in the rendering of land fertile, is breaking and dividing it into small particles, whether this be done mechanically by the plow, or by fermentation from manures: that this is essential to the free growth of plants is plain, because it is from the smallest particles they are nourished, and breaking the land in this manner is the only method of giving the roots a free passage.

But beside these, there are two other articles without which plants cannot thrive, these are a due degree of heat and moisture.

Corn demands a moderate degree of each of these, and the farmer is to guide his practice in such a manner, as to give it a supply without abundance. The farmer may defend his land from cold by fences, and he may keep it moist by tillage.

He is to communicate to his crop all good, so far as he is able, and to defend it from all ill.

One of the greatest misfortunes that can attend a crop, is too much wet. This sometimes happens from the particularity of a season; but oftener from the nature of the land. In the first case, the farmer's care must be to find methods of carrying the wet off; when the latter, he must employ all his care to provide against it. Land that is too wet will never produce corn well, and to prevent this mischief has been invented the practice of which we treat in this chapter, the laying land in ridges.

This is a particular sort of tillage, and its effect is greater than those seem to understand who employ it. They use it only to keep their lands from being too wet, but it has an effect in regard to the degree of heat, not less than with respect to moisture.

We shall see, upon examining this practice and its effects, how well nature has taught people to use it. In the moderate soils that are frequent in Buckinghamshire, and elsewhere, they frequently lay four ridges together: in Kent they often lay six, and in the lower parts of Essex eight, and in Huntingdonshire, upon their wet and stiff clays, they sow all upon broad lands, raising the middle of the ridges in some places two foot and a half higher than the side fur-

rows,

rows. This exposes those tough and clammy soils to the sun better than any other method, and drains them of the abundant wet.

Calcination by fire reduces clay to a rich mould; and draining it of abundant moisture always abates its toughness. These are the effects of dressing such land in this manner. To have the full effect, let the farmer make the ridges run east and west, where the situation will allow it; because the sun gets then at every part of them the better; and to promote farther the other good effect of draining, let him take care always to keep the furrows open and clean scowered. These will serve to carry off the abundant moisture; and to give it a free discharge from the ground, drains must be made in the lowest places, that may run well into one another. This is so essential, that when the plow will not make them deep enough, it should be done by hand with the spade; and the earth that is taken out should, in this case, be carry'd to a distance, that it may not be trampled in again.

The chief design of laying land in ridges is, draining it, and making the corn grow properly dry: but we see that by a proper management it may be made to extend its benefits farther. In this case, of a clayey soil laid in ridges open to the east and west, the sun acts in a double way, not only giving it warmth, but by a gentle calcination of the surface, it reduces that superficial part to a state of greater perfection, and makes it a kind manure for the rest.

The natural defects of many lands, otherwise good, are too much moisture, and a defect of heat. The latter naturally arises from the former; for a quantity of water, detained among clay, or any other tough earth, becomes cold, and chills the plants that are raised upon it. The great remedy is laying the land in ridges. That the husbandman may know when this is requir'd, as well as how to do it, we shall give him the following hints.

In many places the abundance of moisture, and coldness of the soil, are obvious to the eye: the land is clammy and wet the greatest part of the year, and this is not a condition in which it will bear crops to advantage. This plain discovery of the fault is most constant where the occasion lies high, or where the clay makes the whole soil. But the same fault may be in the ground where this lies somewhat deeper, and though it is not perceived by the eye, the effect may be found the same. When a land has a thin, light,
and

and loose soil at the top, and a tough clay at a small depth, the wet will run through the light earth; but it will lodge on the clay. This is a deceitful kind of land. It will look dry, when it is very wet below; and this in the place where roots find their nourishment.

Other wet lands shew themselves to the eye, but the fault of these is to be seen in the growth of the crop. When it is in great degree it discovers itself on opening of the ground, but in a less it is capable of doing great hurt: and it is then known by the aspect of the corn or other growths. If the leaves look sickly and yellow, if they droop, and the stalk rises slowly, we may be sure this is the fault of the soil, and that it is wet and cold: however dry and fair the land may seem on the surface, it is wet at a small depth.

When the cause is known, the remedy is easy by laying up the land in ridges. If the descent of a hill do not prevent, let these be open to the sun, by being laid east and west: thus while the water is carry'd off, the sun will calcine, and every day improve the clayey matter that lies on the surface, from the effect of plowing.

The water runs off from the ridges into the furrows, and is thence to be carry'd by proper drains out of the land.

C H A P. XXXII.

Of the wet land on hills.

THE intent of laying land in ridges, is to drain it of wet. As there are several kinds of lands apt to be wet, and those, according to their differences, require some variation in the manner of applying the remedy, it will be useful to consider them separately.

The two principal kinds of lands liable to be chill'd by wet, are those on hills where there is a bed of clay under the mould; and those in level grounds, with a very deep and very stiff soil.

Rains fall upon this hilly ground, and soaking thro' the mould, are detain'd by the clay. They cannot enter this, and they spread themselves among the mould above; and the whole approaches to the nature of a bog; the ground being soft, and rais'd above the natural level by the water spread among it.

When this is the case in a great degree, no plowing can remedy it. Trenches must be cut a-cross with a descent, to
carry

carry the water off. And they may be fill'd up with rough stones, and cover'd over with earth again, so that all may be wrought as a level surface.

When the wet is in a less degree, it may be discharg'd by laying the land in ridges. Let the farmer first examine whether the state of the ground will or will not admit a cure: if he thinks it will, this is the manner in which he is to set about it.

Let him plow the land in ridges, almost cross-wise of the hill, but a little slanting; in this way their parting furrows lying open will each serve as a drain to the ridge next below it: for when the plow has made the bottom of these a few inches deeper than the surface of the clay, the water will naturally and securely run to their ends, without rising into the mould, provided no part of the furrows be lower than their ends.

This slanting should be more or less, according to the form and declivity of the hill.

There are two ways in which water that falls upon an hill runs off. The one is on the surface, and the other is between the mould that makes the soil, and the clay of the bed under it. 'Tis this second course we are to consider on these occasions; for on that depends the damage we propose to rectify. This is the source of what we have directed, as to the disposition of the ridges; and it will be found, that as only this method of ridging could keep that part of the soil dry, so there is no direction in which they could run, that will so well secure the advantage, as the carrying them with this slant cross-wise of the hill.

In this case the consideration of laying the ridges east and west, must give way to the cross direction with respect to the descent of the hill. We have mentioned, under that head, that there were exceptions; and this is the principal: in this, as in all other cases, the greater convenience is to be consulted, and the lesser is to give way to it.

The farmer will often find two things would be right, both of which together are impracticable: he must, in this case, content himself with taking the best.

The way of working on this occasion is to plow the ridges in places, without throwing any earth into the trenches. The ridges will be plain at the top: and the rain water will speedily run downwards to the next trench, and thence to the head land, and so out of the field.

A great deal of land that might be saved by this easy method,

method, is left to produce little or nothing by the common treatment.

C H A P. XXXIII.

Of the wet land that lies level.

THIS is the other kind of land that is liable to be wet, and may be mended by the tillage in ridges. Sometimes there are springs on hills which makes the cure more difficult: in these deep, wet, and stiff soils that lie on a level, the cause is always in the rains alone. But this will sometimes put the land into as bad a condition.

When a deep stiff soil lies flat, and is plow'd sometimes one way, and sometimes another, it will hold water a long time. By that misfortune the plow is kept out two or three weeks longer than if it were in round ridges: and sometimes its flatness keeps it from drying till the season of plowing and sowing too are lost.

The farmers are backward in plowing the hilly wet grounds in ridges, and more in this. They say it prevents cross-plowing, which they count a great advantage, and they think they lose a part of the ground by the open furrows. But these are mistakes: on such notions which he receives upon credit, depend the greatest part of his disappointments and losses.

Cross plowing is oftener a hurt than a benefit to land: this is certain, and any one accustomed to farming, who will examine what he from time to time sees, instead of taking all things upon trust, will find it so. This therefore is an objection, and the other is intirely an error: for, instead of losing any ground by ridges, it is possible to gain. In the common practice none is lost, and managing wisely, much may be gained.

Ground is gained for the farmer's purpose when its surface is increased, and it is capable of bearing more corn: this is plainly practicable in the plowing in ridges. If we allow two foot in sixteen for an empty furrow, the difference of surface between the rest as it lay flat, and as it is plowed into ridges, is much greater in his favour than this proportion is in loss of quantity. All the surface in ridges is capable of bearing corn, and it is so much ground gain'd to the husbandman.

This is the plain and absolute fact: arguments have been raised against it; but they are frivolous or false. We name

them only that the reader used to see things thus canvassed, may not think we overlooked them. To the husbandman they are of no importance, and to the curious it may be enough to say, that the doctrine of the perpendicular growth of plants, on which all their cavils are founded, is in itself erroneous.

The surface of a field measures more in quantity when in ridges than when flat; and all its surface, the empty furrows excepted, is capable of bearing corn. This is a short state of the case. These furrows have been taken into the computation, and the difference is in favour of the land in ridges. No sophistry can get the better of so plain a fact; and it is upon this fact, and the evident advantage that wet and cold lands receive from this kind of tillage, that we recommend to the farmer the tilling his stiff, cold, moist, and flat lands, in this method.

The quantity of a crop does not depend upon the space there is for the corn to stand in, but on the quantity of earth there is for its roots to spread in for getting of nourishment: the roots of corn spread near the surface, or at a small depth under it; and the increase of the surface of ground in measure, is in reality an increase of it in quantity, so far as the growth of these plants are concerned.

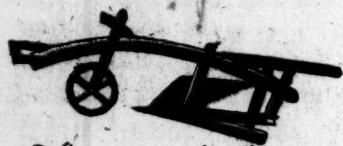
The increase of ground is a certain and a considerable advantage obtained from the plowing in ridges, but it is not the only benefit. Beside keeping the land warm and dry, the ridges are a shelter for one another, and a defence against cold winds; and when the field has been exhausted by frequent sowing, the ridges may be made just where the furrows were, and there will be the advantage of a great deal of fresh ground.

Having explained the benefits of ridges, we shall give the farmer some cautions about the making of them.

In a deep soil let the ridges be made narrower, and in the shallower let them be broader. Let him overlook the work, and have a particular regard upon descending or slanting grounds, to the direction and course of the furrows; and if he intend to follow the horsehoeing method, which we shall describe hereafter, and which in a moderate and proper use has great advantages, he should rather chuse a land that is dry in its own nature, than one that wants this assistance of ridges, for they are often an interruption to that practice.

The furrows should be deep or shallow, according to the





The one wheel'd Plough



The original Plough without Wheels



The two wheel'd Plough improv'd



The original two wheel'd Plough



The four Coulter'd Plough

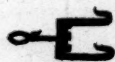
A Nut



The under Sheet



The Wild



The Square Collor



The Piece added to y^e Beam



The fore Sheet



The long Handle

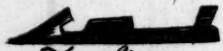


A Coulter



The short Handle

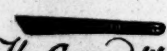
Parts of the four Coulter'd Plough



The Share



The Earth board



The Ground Wrist



The Plough to cut Drains



The wheel Coulter'd Plough

the depth of the soil. When lands are improved by this method of laying in ridges, wheat and rye need not be sown upon them so early as they are in their natural state; but they must still be sown earlier on them than on lands that are naturally dry, and warm. For summer corn, on the contrary, the cold land must be sown last.

In many of the western counties they sow their barley with a broad cast upon broad ridges; and in Kent and Essex they frequently sow it on narrow ridges like wheat: in this case there are to be two small harrows used, one of which is to take each side of the ridge. After this they roll it with a belly roll, which goes between the ridges.

C H A P. XXXIV.

Of the advantage of tillage by the four coulter'd plow.

WE have described the construction of the four coulter'd plow, and having now treated of the nature and advantages of plowing in general, we shall be understood with ease in recounting the benefits that attend the use of that instrument.

Nothing gives the husbandman more trouble in plowing than a strong turf; and there is no method by which he can effect this so well, as by the four coultered plow. The richest land is most subject to this tough head; and the deeper the soil the larger must be the furrows; for if they be too small, a great part of the mould will be left unmoved. A narrow furrow cannot be plowed deep, because the plow will continually slip out from the hard land toward the right, unless the rising furrow be of sufficient weight to press it toward the left, and keep it in the work. The deeper the farmer goes, the greater weight is required to press the plow: so that the deeper the land is, into the larger furrows it should be plow'd. If the work be done with a common plow of the very best invention, the consequence is, that in a very strong land which has rested some time, it is the business of many years to get into a good tilth. This the farmer has never fail'd to find, and his heart will go with me as he reads this account. The price of such laborious tillage often comes so high, that it reduces the profit of rich land below that of poor.

It is a common pretence among plowmen, that when they have slightly broke up a land at the first plowing, they will go deeper, and do it better the second; but they promise

what cannot be performed. It is of the utmost importance to the farmer to cut and divide such ground in the most perfect manner: the common plow cannot do it well, and seldom does it otherwise than by halves; nor is there any other remedy that is not too expensive. For this reason the four coultered plow is proposed. It is useful on many other occasions; but it was invented for this, and will not fail to answer to his perfect satisfaction. Such land must not be plowed a second time in wet weather, for that will make the weeds grow, and if it be done in dry, the plow will never go deeper than it did at first.

'Tis therefore the common tillage does not answer on such land. The farmer sees it, but he knows not how to help himself. If he attempts it by the breast plow, the work is very expensive; and if there be many stones in the soil, it is altogether impracticable. If the turf be pared off very thin with a breast plow, and laid to rot before it be plowed in, in the common way, this may succeed; but if the season be wet, it will grow instead of rotting; so that in most cases that is a very hazardous undertaking, and in many it is not all practicable.

Even digging up the turf with spades would not answer in this ground, unless it were done extremely thin, which will never be procured to be faithfully executed at any expence. As the spring is usually wet, there is danger in cutting up the turf for rotting any way at that time, for fear of its growing; and if it be deferred till summer, the plowing afterwards in dry weather on such a soil will be very inconvenient, and the wheat season probably lost.

In these exigencies which happen most upon the richest land; if the farmer will venture upon the breast plow, or that slight plowing which only cuts off the turf, let him do it not in the common way, but have recourse to that particular kind of plow, which we have directed to be made for the cutting up the turf for burnbaiting, and the roller described with it. These instruments will give him an opportunity of getting up the turf, and cutting it to pieces in a much more easy and expeditious method; but this is by no means comparable to doing it at once by the four coultered plow.

In the common way of plowing, this kind of land cannot be cut in furrows of less than ten inches broad, and to that is owing all the disadvantage: the land is several years before it can be sufficiently broke, and grass and weeds grow with the corn. But with the four coulter'd plow this ten
inch

inch furrow is cut into four equal parts, so that there is no part above two inches and a half broad, and this is done thoroughly; for the coulter cut to the whole depth of the soil, tho' it be fifteen or sixteen inches.

This is a prodigious advantage, and it is done as easy as by the common method of plowing: for before the furrow is raised by the share, the earth lies fast, and makes an equal resistance against all the coulters, so that they all pierce quite through it.

The dividing the furrows length-wise into four parts, is not all the advantage that is gained by working with the four coulters' plow. This would in a manner make one plowing answer the purpose of four: but beside this, it is a natural consequence that the furrow is divided cross-wise; for the ground-wrist presses and breaks the right hand quarter; and the other three quarters, as they must necessarily bend in coming over the earth board, break also in falling into many small pieces.

Nothing of this happens in the working by the common plow, where the furrows being of such a thickness as very well to keep entire; when the soil is any thing strong, it falls whole. Counting therefore the first division made by the coulters, and the second by the natural breaking of the earth, there is no question but the four coulters' does at once plowing, divide the soil more than twenty times as much as the common plow. It has therefore twenty times the use, and does the farmer twenty times the service. This is easily practicable, and he who shall try it will find, that far from our making the most of what it will do, frequently the advantage is much greater. When the mould is of a right temper, the earth board in turning the furrows off will crumble them to pieces: they shall fall into a kind of dust, and hardly such a thing as a lump of any size will remain in the field.

We have shewn that the breaking and dividing the earth into small particles, is the great point in which the benefits of tillage consists; and it is evident from the effects, that one or two common slight plowings after this with the four coulters' kind, will reduce the soil to dust. The whole depth of the soil is directly brought into tilth; and the turf being cut into these small pieces, rots and decays presently, adding a kind of manure to the richness given by this breaking of the soil.

The greatest use of the four coulters' plow is in conquer-
ing

ing a strong turf. When turf is cut up large as it must be by the common plow, the pieces lie hollow, and as the air can come to them, they grow; but being cut into such small shreds by this kind, they lie close and rot, because they have not air for growing. The length of the roots is a great disadvantage in the common way of plowing; for they will shoot from the joints: in the use of the four coulter'd plow, they are not only torn up, but cut to pieces; and those are so short, that if they are buried they rot; and if exposed on the surface, they shrivel and wither: so that either way they perish.

Any weather will do well for plowing with this, in which a plow can be used; but wet is best; it may be used when the ground is ever so moist, provided the horses are not mir'd in drawing it: and there is no way in bringing land into tilth in so short a time or with so little expence.

As we have mentioned the great advantages, we shall name also its inconveniences. The four coulter plow is hard to draw, and its beam being long it lies farther behind, and comes heavier after the horses; its whole weight also is considerably greater than that of the common plow.

For this reason it will be proper to add one horse to the usual number for the drawing of this plow; or if a stronger team be employed, the difference will not be so much felt.

The difference is not so great but that it is near as easily drawn in moist weather, as the common plow is in dry on the same ground, and at the same depth. One great reason of its following heavily is the depth to which it cuts; and this is so great a benefit, that it would be idle in the farmer to grudge the adding of one horse to his team for obtaining it: the four coulters plow will cut two spit deep, which is a prodigious advantage; but when so much is not required, it will cut as shallow as any other kind, and then the weight is very little felt.

The cutting the furrow into four parts, adds to the pull of the horses, but it is not much. When the ground is in a right condition, and the coulters are in good order, they cut through very easy: the furrows being thus divided, rise so much the more freely upon the share and earth board, than they would if whole, that perhaps as much is gained in the ease of working this way, as is lost the other.

Plows with two coulters instead of one have been used in different places, and always with the greatest success; the adding a third and a fourth, must increase the advantage; and

and upon the rules we have given, the farmer cannot fail of having it done to his satisfaction. The difficulty is not great, but the people who make plows are very ignorant: nothing could have brought the plow with two coulters into disuse, but the bad way of fabricating it: and nothing but the properly putting together this new kind can be wanting to the bringing it into general favour.

C H A P. XXXV.

Of the general benefits and advantages of plowing.

WE have consider'd plowing as the capital operation of the husbandman's profession, and have therefore treated it very much at large with respect to the structure and make of the instrument, and methods of using them: that we may leave no useful part neglected, we shall here lay down whatsoever farther of general matter it may be fit the practical husbandman retain in his memory.

The plowing of fallows is a great advantage to them; and tenants are bound by articles to perform it at certain periods for the benefit of the landlord. What is required by the owner, will be also, at proper seasons, a benefit to the person who rents the ground; and in general the expence employ'd in plowing, will bring in many times the sum in the produce. The old authors say, the advantage of fallowing consists in two things; exposing the soil more to the sun and air by turning it up; and breaking the lumps by frequent stirring. This is the old doctrine: it is found in these words in Markham, and that innumerable set of writers who have copied him. This is the principle upon which the horsehoeing husbandry is established: therefore it is idle to consider it as a new doctrine.

Mr. Tull was a person of great industry and sagacity. He read carefully what had been written on husbandry; and he adopted the best things; and improved them. His system is new, but the foundation of it is as old as any thing we know of husbandry. It is unjust to accuse it of novelty and whim, the principles on which it is established are old and true.

The plowing of fallows, beside breaking the ground, kills weeds; turning up their roots to be wither'd by the air, and oversetting the seed shoots before they exhaust the land.

A great caution to the farmer is this, that he harrows no more down in winter than he shall quickly be able to raise

up again in ridges; for if it get wet while it lies flat it will grow poachy. This is the case most in wet lands, and these frequently breed quantities of weeds upon it. The best way is to harrow in an afternoon, what is to be plowed the next morning; or to harrow early in the morning, what is to be plowed a few hours afterwards.

If the summer have been wet, the land will be full of weeds: in this case let the farmer plow it up early in winter to kill the useful growth, and to mellow the soil.

The ancient writers speak of a plow that was managed by one man only, who could very well both guide and drive. Such a kind may be made upon the one wheeled plan; it may be light and small, a single horse may draw it, and a single person manage it: but this, though familiar, will be of a limited use, for it is fit only for a light and well wrought soil, and is to be used only in sowing time. Such a one it may very well be worth the farmer's while to have when he has that kind of land.

They use at this time, in some parts of the west of England, a plow that has neither wheel nor foot. It is made upon the principle delivered in Blith's husbandry, but it does not answer so well as he seemed to think it would. The use of it is confined to ground that is clean and even, for where there are roots or irregularities, it does very poorly.

The farmer is to take his choice, suiting the kind of plow to the use. These two last we have named here, because tho' good on particular occasions, they are not to be rely'd upon in general practice.

Dr. Plot and others have talk'd of digging ground for corn with the spade, and managing a field as a garden. There is no doubt of the success of this, but the expence must be too great; and by the methods already directed, the same advantage may be obtained with more ease, and at less expence.

There is yet another method to be named on this occasion, in which the plow and spade are employ'd together, this is called plow-trenching. It is used in deep light land. One furrow is plow'd, and half a dozen labourers following at proper distances one from another with spades, are to dig in the furrow, and throw up the earth on the glebe turned by the plow. While the diggers are at this employment, the plow is to turn up another furrow at a reasonable distance; after which the labourers are to do the same there, while

while the plow is turning the upper earth of another into the former trench.

The principle upon which this is founded is right, but the method in the highest degree awkward. We have named it that the reader may know what plow-trenching means; but we have delivered methods of answering the same purpose in so much easier a manner, that this will never be found worth his while.

C H A P. XXXVI.

*Of the benefit of converting pasture into arable land,
and of continued plowing.*

WE have mentioned the propriety there may sometimes be in changing pasture into arable land, to keep up the proportion of the two: but this is not the only consideration that may lead to such practice. Pastures on certain soils are apt to spoil themselves, and that when they are rich as well as when poor.

Moss is a great enemy to good pasturage, and frequently land are over-run by it. In this case, if the proper manures prove insufficient, the farmer must have recourse to plowing. That always succeeds: there is no way of destroying moss like it; and after a few crops the land may be laid down for grass again.

In barren and neglected land, plowing is the immediate method of improvement. The breaking the soil gives it fertility, and kills the weeds, by tearing up and exposing their roots.

Sometimes a wet summer will fill a land with weeds after the last plowing in the fallow, by which it was preparing for barley; in this case it must have another stirring during the winter. Some tear them up with a harrow; but plowing is much better; and the land is then to be laid up high, that it may keep dry the remainder of the season: by the effects of frost and air after this, it will be prepar'd for the seed time in spring.

The common method of farming is by the use of tillage and manures jointly, and it comes at a very moderate expence. Supposing the land to be out of heart, and to take in the whole ordinary compass of the business it is this. In April, they lay on twenty load of dung to an acre, which costs about a shilling a load; the ground being already

in tillage, there will require two plowings to prepare it for wheat. Each of these will be about four shillings an acre, and the land will be then ready for wheat in the beginning of October; the seed will cost about five shillings a bushel, and about two bushels will be required to an acre: the weeding, reaping, and binding, will afterwards cost about five shillings an acre more: and the inning of the harvest, and repair of fences, may be set at six shillings an acre: the price of thrashing is according to the richness of the crop, for the labourer is paid by the bushel. Here is all the expence, and all the trouble, and the harvest, at a moderate computation, yields thirty bushels of wheat an acre.

After this, the land will very well bear two crops, one of barley and another of pease, or the like.

These crops are of less value, but they come at a less expence. Barley is mowed instead of reaping, so that the great charge in that article is sav'd; and pease being cheaper in the seed, and requiring to have the ground but once plowed, comes yet more reasonably.

Seven shillings an acre is saved in the crop of barley, and thirteen shillings in that of the pease, beside the saving of dung, so that the charge of these crops is much less than that of the wheat, as well as the price in the produce.

This is all that the country farmer in general knows of husbandry, and thus he practises it. Yet even this way the profit is such, that he can live and lay up some money. The expence of an acre of ground for three crops, is about five pounds, thirteen shillings; and the produce of the three, computing in the most moderate way, is about eight pounds.

This shews husbandry to be a profitable occupation; but when we come to the better practice of it we shall find the produce of land, where the most expence is employed, is six, seven or eight times equal to the charge, and often much more.

This may tempt some into the profession, who have genius capable of improving it, which will be an advantage not to themselves alone, but the kingdom; and it may shew those who are employed in it already, how extremely it will be worth their while to study the rules and nature of its operation more deeply: as every part of their additional knowledge will be an addition to their income.

C H A P. XXXVII.

Of harrowing.

THE great purpose of tillage is to break the earth : the plow begins this work ; cutting it up from some depth, and throwing it by, more or less broken, according to the nature of the soil and the form of the instrument : but though this is a material part, it is not all. The harrow and other instruments follow, whose use is to break and divide the furrows still more.

In the old husbandry they employ'd men to follow the plow with instruments called hacks ; these were a kind of hoes, but stronger in the handle, and hollow in the blade.

The hackers follow'd the first plowing, and cut and hack'd the larger lumps to pieces, and after these followed the harrowing. The present practice having greatly improved the plow, there is no need of that expensive manual labour, but the next operation to plowing is harrowing.

The harrow is an instrument armed with iron points, which being drawn over the ground tears up the lumps, and breaks them to pieces.

It is drawn by horses, and according to its form requires more or fewer, and does more or less service ; but in general it breaks the ground, and brings up a great deal of good mould.

Various methods are used in sowing, in different places, and with respect to the kinds of the crop, these will come hereafter into consideration. But here it may be proper to observe that the harrow, besides breaking the ground, is used also in covering the seed.

It is performed one or more times, for breaking the clots, and when the corn is sown, the harrows are drawn over it again, to cover it. This answers a double purpose ; for beside the covering the seed, it breaks the clods again, and scatters a fine dust over the grain, which is of the greatest service in its first growth.

The plow answers to the purpose of the spade in gardening ; and the harrow serves in place of the rake.

The lighter and looser the earth is, the more compleatly the plow breaks it, and the less need there is of the harrow : but there is no ground that will not be the better for that harrowing which covers the seed. When this is omitted, the corn is thrown among loose clods of earth. It is left
naked,

naked, and is ready for vermine ; and when it shoots has neither fine mould about it, nor is able to penetrate these tough lumps. It languishes therefore in a soil that would, in proper order, support it, and this proper condition is given it by the harrow.

Let the husbandman while he makes himself sensible of the advantages of harrowing, be cautious that he do not expect too much from it : it is an error the present farmers very frequently run into. They neglect to give their land a due plowing, trusting to the harrow to make it fine. When they have thrown in their seed, they go over it with this instrument ; and being sensible the clods of earth must be broken, and that they have not done this sufficiently with the plow, when they see once or twice harrowing does not effect it, they go over the ground again and again ; the feet of the horses thus tread the soil into a hardness that is very unfit for the growth of any thing.

C H A P. XXXVIII.

Of the various kinds of barrows.

THE harrow as it follows the plow in use, probably was the instrument next invented after it. It was clumsy and inconvenient in its first contrivance ; and has been, from time to time, improved.

The common harrow consists of cross beams and iron spikes ; and should be made firm and solid. Let him see the spikes, or tines, are large and well fixed, and in the working let him have an eye that it go evenly over the ground.

The great harrow differs from this in its bulk, and the solidity of its structure. It is a stouter instrument, and every way better fitted for service. It consists of eight beams, disposed cross-wise, as in the common harrow. These are seven foot long, and four inches and a half square. The tines, are like the wood-work, large and massy ; twice as thick, and once and a half as long as those of the common harrow. The wood-work should be ash, and if it be not framed very well together, it will tear itself to pieces presently in the working. The tines are to be placed at the same distance as in the common kind.

The use of this is for breaking the ground, the seed is to be covered in the same field with the lighter harrow. This requires three horses to draw it : and in strong lands sometimes

times more; but by its weight, and the length of the tines, it tears away very deep, and has a force to break the clods much better than the common kind. This is fittest for stubborn land; and is there of such service that the farmers think its effect equal to a slight plowing.

It may be dangerous to trust to it in this respect so far as to neglect the necessary plowings; but following these and in some lands following the roller, it will be of vast advantage.

The drag differs in nothing from the great harrow but in weight. The great harrow is sufficient for all its purposes, therefore this invention was unnecessary.

The drag is composed of eight beams, each eight foot long, and of great thickness: they are placed cross-wise, but at large distances; and the spikes which are very thick and long, stand at greater intervals: it cannot be managed with less than four horses, and sometimes they add a fifth, the four in couples and the odd one alone in front. This way it is lugged along very unevenly and irregularly; it digs deep, and tears up a great deal, but the distance between the tines makes it leave also a great deal untouched, and many clods unbroken.

The principal use of these drags, is on land newly plowed up from sward. When the soil is rich, and the turf tough, there is nothing more difficult than getting the land into tilth. We have explained these difficulties before, and recommended the four coultered plow.

When a land of this kind has been plowed up in the common way, the furrows being large, the turf lies in long ropes, and will continue growing. To prevent this, these furrows must be broke to pieces. This has been tried by cross-plowing, and the drag, but both with little success.

In the common way with the plow, they lie too loose to make a due resistance to the coulter; they rise before it, and are dragged into irregular heaps, and thus left about the field instead of being cut to pieces. The turf, instead of rotting, grows on; and defeats the purpose of the tillage.

With the drag it is still worse. They draw this a-cross the field to tear the grassy furrows to pieces; but it cannot succeed to any purpose, for these furrows are firm and tough, and require a keen edge to cut them. As the coulter could not do it in cross plowing, it is impossible the tines of this drag should; for they have no edge. In general,

ral, although some parts are torn in pieces this way, the most of the turfy matter is in a worse manner dragged up in heaps, and the under part of the earth is often left bare for great spaces.

This is not answering the purpose : we have shewn what method should be used ; and as this instrument does not succeed for this, neither will it answer to any other useful purpose. We have mentioned its form and make, that nothing might be deficient ; but we advise the husbandman to have nothing to do with it : let him trust to the common harrow in light soils, and to the great harrow in the others.

We are yet to mention another kind of harrow, since it is customary to call it so, which is used in grass lands.

This is not composed of beams and tines, but of some slight wood-work, and bushes ; it is thence call'd the bush harrow, and is used for spreading the dung and other manures, over the grounds. The benefit is very great, tho' of a kind altogether different from that of the other. The use of that is to break the earth, the business of this is to spread what is laid on for enriching it.

We have treated of those manures which are to be used on pasture grounds. Whichever of these are employed, let the farmer as soon as he has got, spread it upon the ground, send in women or children, or others who work cheap, to pick up the sticks, stones or whatever rubbish may have come among it ; and then have recourse to the bush harrow, for dividing and distributing the manure.

Whatever care may have been taken in spreading it by hand, many of the clods will remain unbroken, and it will lie thicker in some places than others ; it must be broke perfectly, and spread equally ; and this is the office of the bush harrow.

If the manure be of a tender kind, as the bottoms of hay stacks, rotten dung, or the like ; he may immediately draw this harrow over it : but if it be harder, as the mud from ponds that has some firmness, or the like, let him leave it spread on the ground for some days ; and after the sun has crack'd the lumps, take the advantage of the first shower, and then use his bush harrow.

Its make is plain and natural. Nothing favours so much of the old husbandry.

The original bush harrow consisted of a hawthorn cut fresh from the edge, with a little load to press it down :

this is still used in some places, and, when rightly managed, does as well as any.

Let the farmer look among his hedges for a small leav'd bushy hawthorn : and chuse the most shrubby he can find. Let him cut down a large stem, and laying it on the ground beat it flat with a board ; such boughs as will not be beat down must be cut off, and thrust into the body of the bush in the openest places ; and some other boughs from the hedge may be used to thicken it, if there be farther occasion. These are to be well tied in, and when the surface is flat, full, and very rough, let it be laid on the ground again, and two or three good logs of wood tied upon the back to make it firm and heavy.

The harness of a single horse is to be fixed to the end of the stem where it was cut off, and thus it is to be drawn over the ground : and it will tear and scatter the manure.

This is the bush harrow of the oldest writers, and as it was doubtless practised from the first invention of manuring pasture ground : its improvement brings it nearer the common harrow in form, but the material part is the same ; for the work is performed by natural bushes. The method is this.

Lay an old gate upon the ground, that is not rotten, but will hold well together. Cut up a parcel of blackthorns, and take the bushiest and roughest of these. Draw them in ; and work them between and among the bars of the gate, fastening them by nails, cords, and otherwise, till the whole surface is well covered, and very rough : then turn it up, and the bushy part lying to the ground, it is fit for use. The traces are to be fixed to the center of the gate, and it is to be dragg'd over the ground. This is more compact than the other, but it is heavier. The bars of the gate serve as the wood-work of a harrow, and the bushes answer the purpose of teeth. The blackthorn is preferred on this occasion because it is tougher, and the thorns are harder. It would be better for the other purpose, but that it does not grow large enough to be used singly.

Which of these two kinds the farmer should prefer, must be determin'd by the manure. The first kind is easily drawn ; the advantage of the other is, that it is heavy and strong. When the manure is of the tenderer sorts, the first is best ; but when it is tougher, and the clods require more breaking, the other.

These harrows are to have a hook of iron for the fastening the

the traces to them by which they are to be drawn ; and this should be well fixed on the inside.

CHAP. XXXIX.

Of the drill harrow.

THIS is a harrow of particular form, and very late invention, but it is of excellent service. The drill husbandry is one of the greatest improvements made within this century, and this instrument does a part of it.

The method of drilling is this ; when the ridges are properly raised, and are become moist enough at top, they are harrowed lengthwise, and then they are drilled. Once is generally sufficient, but the eye of the farmer is to judge whether it be or not ; and, if not, he is to order it to be repeated.

If he find after this, that the tops of the ridges are not levelled fit for the drill to pass thereon, and reach to the due depth, the ground must be harrowed a second or a third time, till it be in a proper condition.

The land being prepared, the drill is to be brought on. This makes channels for the reception of the seed ; and that these may not remain open, the drill harrow follows, and drawing the earth together fills them up.

The harrowing the ridges to prepare for the drill, is to be performed by the common harrow. The drill harrow follows the drill plow, and is of no other use than the covering up the seed in those trenches wherein it is laid, by this particular method of husbandry.

It was needful to say thus much in this place to explain the operation of this instrument, which will be understood more fully when we treat of that method : having thus far explained it on the present occasion, we shall be understood in the description of the instrument.

This is exceedingly plain and simple. It is never used, but to follow the drill plow ; and consists only of two beams, by which it is fastened to the plow ; a cross bar fixed to those two beams, and a couple of wooden teeth let into that bar.

In the common wheat drill plow, the harrow is thus constructed.

The legs are a couple of narrow and flat pieces fastened by a couple of stout iron pins, which pass through the tops of the legs, and the beams of the plow, and are fixed on the
outside

outside by nuts and screws. These pins are square where they pass through the beams, that they may be held the faster; but they are to be round near the heads that the harrow may move freely on them. The other end is cut round, and they are let through the cross bar, which is called the head, by holes made for that purpose; and are pinned in behind it, that either tine of the harrow may descend at the time the other rises, where the ground is uneven. The tines are flat pieces of wood, and they are let through the cross bar at two and twenty inches distance from one another. They are to be pinned in above the head; and each is to have a shoulder underneath. These are to be set sloping, so that if they take hold of any clods, they do not drive them before them, but rise over them.

They must be of such length as to give room for the harrow to sink and rise without moving the shares; and to give them the more room, the legs of the harrow are to be bent downwards, towards the middle.

By the distance allowed to two tines, each tine going three inches and a half on the outside of each channel that is next it, fills it up with earth upon the seed from the outside. This gives an inch in the two rows distance when they rise; for, as they will come up nearer the insides because the earth is thrown in nearer the outside, they will stand but fourteen inches asunder, tho' the channels were made at fifteen inches. The sloping of the points also, which is to be made outwards, brings in so much the more earth to the channels.

When this harrow is found to be too light, a stone is to be tied to the cross bar or head, and fastened evenly upon the middle of it: or a box made of boards, and fitted on in that place it is used, which is filled with earth or other weighty materials to keep it steady. A triangular harrow with many tines, may also be made for using between the rows in the horsehoeing husbandry.

In most lands the harrow, which is a part of a drill plow, is sufficient for covering the seeds, but not always: the farmer is not in favour of any new contrivance, to give up the old when they may be useful.

There are occasions on which the common harrow may be well called in to assist this drill harrow in covering the seeds.

In tough soils when drilled late, and the earth is moist, it

will stick to the shares in great quantities ; and not only the motion of the plow is hurt, but the channels will be in part left open by the drill harrow.

It will be best in such land to take off the drill harrow from the plow, and trust to the covering of the seeds up in the channels, entirely to the common one.

When the drill harrow is taken off, a man may follow the plow in these soils with a paddle, or a forked stick, to clean the sheats from this stiff dirt. The channels with the seed in them, will lie in many parts open, and a common harrow is to be drawn over the ground to cover them. If the farmer chuse to improve his drill harrow than to employ the other, he may order it in this manner. Let the tines be of iron ; and the legs be placed at the end of the plank, remote from the sheats of the plow. The sheats may then be cleaned, tho' the harrow be on, and these iron tines will not fail to cover the channels.

The drill in this case should have only two shares, and they should stand at about fourteen inches distance. The harrow answers its purpose in spite of the inconveniences of the ground.

This is the way of making the drill harrow answer on all occasions ; but it is a good method for wheat, to draw a common harrow once over the ground afterwards ; for nothing lays it so well.

It will be best to use two harrows coupled together ; and they should be of the lightest kind. The pole that fastens them together should be tied in two places, that they may always go level. This is a proper caution for harrowing land in ridges ; for otherwise the ridges will be too sharp at the top, and the partitions might lie higher than the rows.

The harrowing of ridges must never be cross-wise, unless they are to be made level for cross plowing, in order to lay out the ridges in a breadth different from that they had before.

When the ridges are too high, they may be lowered by this harrowing ; and it is not attended with the common mischief of treading down the ground, for the horse when he draws two harrows together, treads in the furrow that is between them.

CHAP. XL.

Of rolling.

ROLLING is an old practice of husbandry. When the use of the common roller was not known, they used other means to break the clods of earth; and these under the name of mallets, or mauls, are employed at this time in many parts of the kingdom. The roller is much more convenient, and ought to be taken into their place.

As harrowing is sometimes performed before, and sometimes after sowing, so is rolling; it is sometimes used before, sometimes after harrowing; and very frequently and properly between the two harrowings of the ground.

Where there are lumps of a dry and brittle earth, the roller answers very well. It should be used only on such lands; but the husbandmen of England, for want of making proper distinctions, do themselves great injury.

In barley land the roller not only breaks the clods, but smooths and levels the surface for mowing.

In the old husbandry when they had sown the ground, and harrowed in the seed, they used to go over it with a great wooden beetle: with this they broke the clods left by the harrow; and when this practice had not divided them sufficiently, they afterwards took the advantage of the first good shower, and went over the field again with another kind of beetle, and broke them again. This last weapon had a flat piece of board fasten'd in a slanting direction to the handle, of about a foot square, and two inches thick. They usually made it of ash, and by its blows striking it down and drawing it back, they broke and pulled the remaining lumps to pieces.

These operations are supplied by the roller with more convenience and ease. But a caution is to be given the husbandman, that he do not make that hurtful which might be beneficial. When the roller breaks the lumps of earth it answers its purpose. It does this when it is used on proper soils, and at proper seasons; but otherwise it may take a contrary effect.

When the earth is tender and the season dry, the lumps are no way broken better than by the pressure of the roller: but if the farmer will draw this heavy implement over a piece of land of a tough soil, and in a damp condition, he

will press it into cakes instead of breaking the lumps; and this instrument will in a manner un-till the land instead of tilling it.

This is most mischievous when practised after the seed is sown; for, in that case, it squeezes the soil into cakes, which its tender shoot will not well be able to pierce; and makes it so tough, that the small roots will difficultly make their passage.

This is the condition of such land before it is tilled, and the rolling it after sowing in this manner, does a great deal toward reducing it to the old condition again.

All strong land when it is broken by tillage, is put out of its natural condition; and is, from that time the tillage is ended, subsiding and saddening into its old state again. This is the husbandman's misfortune; but he must be very blameable if he assist it.

From this reasonable account of the nature of tillage, and the effects of rolling, it will be seen that the great use of this instrument is on light dry soils; and that its best service is when it is used in the intervals between one harrowing and another.

For barley land it is very fit to be done after sowing, rolling with discretion, and avoiding these errors. Its use, in this case, is evident; because the smoothness and levelness of the ground makes it fit for mowing: but, in the other case, it is a proper instrument in the immediate purpose of tillage, serving to break the clods and divide the soil.

This is the great use of the roller, and the proper time for it is between the harrowing and the second plowing.

When a piece of land has been plowed once, let it be harrowed: this breaks many of the large pieces, and tears up the clods: then let the roller be drawn over: it will break the rest in a proper manner, and prepare the land for plowing again. This successive use of the plow, the harrow, and the roller, is the most regular and certain way of breaking and dividing a hard soil, and breaking it into a condition to nourish the crop.

CHAP. XLI.

Of the several kinds of rollers.

ROLLERS are of different forms, and materials. Some are simple, and others armed with spikes, or cages. In gardens they use them of stone or iron, but in fields

fields they are of wood, except the short roller for horsehoeing husbandry.

The common roller for the field is made of the trunk of a thick tree. It should be eight foot long, even all the way, and fix'd in a plain frame, in the which it can turn with ease, and be drawn by one or more horses. From the fore part of the frame run a pair of wooden shafts, and the hinder horse is put into these for drawing.

That us'd in the horsehoeing husbandry, is a plain roller also, though differing in size and materials.

It is made of stone, and seems of a middle kind, between the garden and the field roller: it is a small stone roller, set in a two shaft frame for the convenience of being drawn by a horse.

The stone is to be a yard long, and two foot six inches in diameter. Of this soil it generally weighs about eleven hundred weight; so that it is capable of pressing firmly, and is so short that it is easily managed.

The shortness suits it to the purpose of that husbandry, because it can be drawn in the spaces where the common great roller could not come.

The frame is very plain, it consists only of two legs or limbers, through which the axletree comes at each end, and which are joined together by a couple of cross bars near the stone. A couple of pegs are driven in each limber near the point, which serves to fasten in the horse.

The two cross bars are to be of wood, and they should be strong, and fastened into the limbers by pins. The end of the axletree of the stone must not stand out beyond the surface of the limbers, because they would do mischief by laying hold of the plant, as this is to be drawn between the rows while growing; and the hinder ends of the limbers should be made to turn a little up for the same reason.

This must never be used but in the driest weather; because by its weight it is capable of doing more harm than any other kind.

It supplies in this season the use of the plow and harrow, breaking the clods almost to powder; so that the least rains afterwards dissolve them.

It is excellent for preparing the ridges for turnips. When the land is in such vast lumps at midsummer, that neither the plow nor harrow can touch them, this roller will break them, and the land may be easily plowed and harrowed afterwards, so as to be made fit for the seed.

The spiked roller is excellent to subdue the stubborn land in dry summers. When the ground can no other way be got into order for turnips, this followed by the great harrow, are excellent.

In making the edged roller, the only caution is, that he make it heavy enough, and the blades stout and sharp. They will be useful on other occasions, beside that of burn-baiting: and indeed wherever there is occasion to cut thro' long and ropy furrows, no instrument is so proper.

C H A P. XLII.

Of the great advantages of rolling.

HAVING mentioned the several methods of rolling, we shall add the advantages of that instrument, all of which are perhaps not sufficiently attended to any more than the inconveniences.

The mischief that may attend rolling, is pressing down and hardening the ground; but there are lands of so light and loose a kind, that this pressing them may, at a proper season, be an advantage to them.

We have mentioned the good, sheep do to light soils, by treading them when put upon them; and these when they are of the most crumbly kind, are often rendered so loose by the weather, that they cannot afford a sufficient hold to the roots of the crop. In this case the use of the roller is excellent, for it presses and fixes the soil.

This is so necessary in some places, that the farmer, though he work his soil ever so well, if he omit to roll it, will never get half his crop. Chalks, and the white clayey lands are of this kind; and some others.

Barley is the crop they roll the most constantly; but taking proper opportunities, it is equally serviceable to beans, pease, and other kinds, not excepting wheat.

It destroys insects, and particularly the slug. This creature devours immoderately. Of all crops pease are its favourite; and it eats them from their first shoot, till the time of gathering. The great abundance of this creature is in the beginning of spring, especially if the season be warm and showery; and its principal time of eating is the morning; as the day rises it gets into the ground.

This will inform the farmer how he is to destroy it.

Early spring is the season for rolling, and he must do it while the creature is above the ground.

By

By this he will destroy the enemy of his crop, and make the loose earth firm for its support.

The time of the slug's greatest abundance, is the best season for rolling his fields; because his crops are at this time in a condition to bear it, which they will not when they are more grown.

The true season for rolling corn is the beginning of April, and the best method is to roll that which lies in broad lands twice in a place, beginning at day-break.

In dry and loose soils the roots of corn are parched and burnt up in long draughts; and they will suffer greatly by but moderately hot and dry weather while they are young. This loose earth not closing about their roots, gives passage to the air and sun directly to them. The roller presses and flats down the surface, and puts them into the condition of such as are heavier.

This rolling the earth while the corn is young, has also the effect of giving it another dressing, for it breaks and presses the little lumps of the soil to pieces.

In all this the farmer is to take care that he do not, by rolling improperly, do more mischief than he can possibly reap advantage. We have advised him against rolling tough soils, and against rolling any in wet weather: and this last is so needful a caution, even with respect to the lightest lands, that if he should attempt it he would destroy his crop. The feet of the horses would do incredible mischief, beside the action of the roller.

Corn must be at a proper growth before the roller is introduced. The leaves must be strong, but the stalks must not be hardened. And though moist weather is known to call out the slug, the farmer must stay for some that is dry, before he can take this method of killing it.

Wheat in a loose soil, may be rolled in October and November, and in January, February, and March; the winter rolling will prevent the ill effect of frosts, as the spring rolling will that of droughts.

Care is to be employed also in the rolling of barley. This must not be rolled too young, for then the pressure of every clod will crush and destroy a leaf, and the roots having little strength, will not be able to renew it: and if it be rolled too late the stalks will be broken, and the crop that way spoiled.

The prudent farmer will see there is not any part of his profession which requires so much judgment as the rolling

corn

corn lands to advantage. The soil, the growth, and the weather, are all to be carefully observed: when these favour, the benefit of rolling will be very great; but when they do not the mischief may be greater.

The roller is used on pasture ground as well as corn lands, with considerable advantage: the season for that is March, the earth being then a little moist. It crushes down worm casts, small ant-hills, and rising mole-hills, establishing the earth about the roots of the grass, and making the surface level for the scythe. There will need no farther caution on this head, but that the roller must always be of the heaviest kind.

BOOK VI. PART IV.

Of the different manners of sowing.

C H A P. XLIII.

Of sowing in general.

THE operations of husbandry are not limited to one time, or to one use; but the same practice answers several purposes, and may be equally proper at different times.

Rolling is perform'd, on some occasions, before the seed is sown, and on others after. In the first case it serves to break and divide the ground; and in the other to destroy vermin, to fix the earth to the roots of the plants, and to prepare the surface for the scythe. 'Tis the same with harrowing, which serves in one case to break and prepare the land for the seed, and in the other to cover it.

We might therefore have introduced this article of sowing either before, or after, those operations; but we have chosen the latter, because those articles being dispatched, there will be nothing to break in upon the course of our method, when we proceed from the ordinary manners of sowing, to that by the drill husbandry, which naturally leads to the article of horsehoeing, and thence to the cutting and carrying in of the crop.

We have caution'd the farmer, when he is about to raise a plantation, to chuse properly his seeds of the trees: there is as much cause to be careful in the choice of seed for his arable land: and many of the same rules hold good with respect to both.

The

The first consideration is the kind and soundness of the seed.

Let it be had from another land, not the farmer's own, on which it is to be sown again; and it will be best if, with a proper degree of goodness, it hath grown upon worse ground.

Where the seed is no way different, and the nature of the land the same, it is of great advantage to change it. Thus two farmers at forty or fifty miles distance, will mutually find advantage in sowing each on his land the corn that grows upon the other's.

Seed from a colder climate succeeds best upon land that lies warmer. The English farmer will be sure to find his advantage, if he will get from the northern counties his seed for the southern: this is the same kind of benefit with that of sowing seed from a poorer on a richer ground: the favourable climate advances it beyond its natural goodness.

When a dry soil is to be sown, wet weather should be chosen, if the seed be of a nature to bear wet; on the contrary, in moist land a dryer season is to be preferred.

Let the farmer sow wheat in wet weather. It never is too wet for this purpose, when the horses and instruments can go without clogging. On the contrary, let him sow rye in the driest seasons. This will come up at its proper time, without rain; but wheat, if sown in a dry season, will be six weeks, or more, before it appears, if there fall no rains afterward.

In general summer corn does best when sown in dry weather: only black oats are an objection; they require a great deal of moisture.

Wheat not only will lie without shooting, when the season is dry, at and after the time of sowing it; but a great deal of the seed will be lost; for while it lies and does not grow, it will be in danger of decaying.

The manner of sowing differs on many occasions, sowing under furrow, is sowing the corn in the furrow, and plowing a ridge over to cover it; sometimes they harrow the land, and sow wheat or rye upon it with a broad cast, some only with a single, and some with a double cast, and then plow it upon an edge in broad lands, when the land is dry. Some plow their land up an edge for broad furrows, and sow their wheat or rye on it, and then harrow it over. In strong and tough soils the superficial methods are best, and the method of sowing under furrow is better in lighter: but these,

these, and the other methods of sowing at random, are very imperfect, and therefore less need be said about them. Their faults lead us naturally to that excellent method the drill husbandry, by which every thing wrong in the usual way is set right; and this we shall, according to its merit, treat of at large.

C H A P. XLIV.

Of the depth at which seeds are to be sown.

IN the methods already mentioned, corn is sown at random. It is scattered in an irregular manner, and cover'd afterwards to an uncertain depth.

Corn will grow from one depth better than another, and the more regularly it is sown the finer it will rise. The intent of the drill husbandry is to distribute it properly, and to cover it in such a manner as best suits its growing.

All plants are not to be sown at the same depth, some requiring more moisture and more shelter than others: some rot at those depths at which others will grow best.

Let a trench be cut two foot long, and at one end let it be two foot deep, and at the other terminate at the level of the ground, the bottom all the way rising in a slanting direction. On the bottom of this trench, all the way up, let there be scatter'd seeds of different kinds, and then let the earth that was dug out be thrown lightly in again, covering the seeds every where, and filling the trench up to the level of the ground.

It will be found, by this experiment, that none of the seed which the farmer has to do with, will rise when they are buried at more than nine inches depth. At six inches some kinds rise very well, and others scatter'd with them not at all; and other seeds do not shoot, unless they be within an inch or two of the surface. This is a plain experiment, and there can be no error.

Trials of like kind will also shew, that seeds of the same species may be buried at a greater depth in light, than they may in strong soils. And that certain seasons favour the shooting of seeds more than others.

Warmth and moisture are the great articles for promoting the growth of seeds. The same kind buried at a depth somewhat too great, will shoot and succeed if the season prove favourable on these two accounts, which if it had been dry, especially if cold, would have lain there without growing.

In

In some cases seeds will corrupt and grow mouldy, when they are covered too deep for their shooting; but this is not universal. Experience shews they will lie unhurt in this manner, in some soils twenty years: so that on turning up the earth after that period, and bringing them nearer the surface, they grow speedily and well.

It seems, that in some instances, the seed of plants will lie longer than this, for in many parts of the isle of Ely, they never turn up the earth in a ditch bank, but there grows mustard upon it, although there were none before upon the ground, or in the neighbourhood of the place. The same thing I have observed about Chelsea, with respect to the plant call'd erysimum, or hedge mustard. This never fails to shoot up where the soil has been open'd to about two foot depth. Unquestionably the seeds of these plants have long since, by some accident, been buried in the earth in these places, and they keep good there till removed nearer the surface, though they lie too deep for shooting. Air is an immediate necessary to the growth of seeds: it is more required to some than others; and none will grow unless it can operate in a degree suited to its purpose.

The husbandman will find he may preserve any seed for a long time good, by burying it in a proper manner; and he will see that every seed has a particular depth, in a moderate soil, at which it grows best. He must in his practice conform to this knowledge, varying a little according to the nature of his ground, sowing deeper than the exact rule in very light, and not quite so deep in such as is very tough and strong. The air has a greater effect at the same depths in lighter than in heavier soils.

When the farmer has this knowledge with respect to seeds, let him consider the several kinds, and examine what depth of covering agrees best with each.

To this purpose Mr. Tull has proposed the use of gauges, which determine the matter with the most perfect exactness.

C H A P. XLV.

The practical method of finding the proper depth for seeds.

A Seed is to be sown at that depth from which it will come up most favourable: every seed has its particular depth for a moderate soil; which is to be encreased a little in a lighter, and a little diminished in a tougher ground:

ground : and this is the whole consideration. When a seed is sown at a less depth than proper, it is dried up, when at a greater it is buried : if it be much less or much greater, it will not grow at all : and if but little on either side, it will grow less perfectly and beneficially to the farmer, in proportion to the degree of his error.

The gauges for determining the proper depth, are made in this manner. Saw off twelve sticks, of three inches diameter ; bore a hole in each stick, and drive into the hole a taper peg. Let the first peg be half an inch long, the next an inch, and so on ; every peg being half an inch longer than the former, so that the last peg will be six inches long,

Dig up well a piece of ground where the crop is to grow.

Let the surface be laid even, and let the farmer make twenty holes with his half inch gauge in a row, drawing a packthreak line across the piece of ground for that purpose. Let him have some choice seeds, and put one in each hole. Let him cover them up, without raising the earth over them ; and stick down the gauge at the end of the row. All the seeds will be thus buried half an inch deep, and no more, and the gauge being left will be a rule to know it.

In the same manner let him use the other eleven gauges : after making twenty holes with each, and putting twenty seeds in them, let him cover them up, sticking the gauge at the end of the row, and wait the event.

He will see which comes up first, which grow best, and which do not shew themselves at all. From observing which depth there answers best to that particular seed, he will see what is the proper depth for sowing it in his field.

This is the foundation of the drill husbandry. So simple and so rational is the original of that excellent improvement.

Let the farmer thus try every kind of seed before he sows it, and knowing its proper depth, let him set the drill accordingly. Black oats, when the drill is set too deep, will scarce come up ; and most kinds, if sowed too shallow, are injured ; a great part of the seeds not sticking root, and those which do, growing poorly.

The danger of sowing in winter is, letting in the seeds too deep, as in the summer it is the setting them too shallow. In tough grounds the great caution is to be us'd against going too deep ; as in the soft and tender soils, it is most likely to err in setting them too near the surface.

The farmer who tries the seed with his gauges upon the ground

ground where it is to grow, makes himself secure: and as he can, by properly setting his drill, be sure to let in all the seed for his crop at the same depth, he will not fail of success.

It is best to repeat this method for every field: but he who wishes to spare himself that trouble, when he knows by experience the proper depth in one place, may vary a little in others, according as they are of tougher or lighter soils.

The setting the seeds by the gauges, serves also to inform the farmer exactly of the goodness of his seed. This is an important point, and difficult to be determined: seed corn may have faults that escape the eye, and will not be discovered by any of the common methods of trial. If it be good there is no reason he should sow more than the necessary quantity; if indifferent it is fit he sow the more of it: he will know what he is to do from the success of the seeds set by his gauge.

Those seeds which rise from the greatest depth, are not to be sown at the lowest they will bear, especially wheat, in a land that has a damp bottom; for in this case the wet will chill the first roots, and check the growth of the plants.

Some differences also are to be observed according to the nature of the land, and the manner in which it is laid, whether that be flat or in ridges, as also with respect to the season of sowing. In all these the farmer's reason and judgment are to be his guides, no general rule can suit every circumstance. The method of giving directions usefully, is to lay them down in a middle way; supposing the soil, the season, and all other accidents, moderate, neither particularly right, or particularly unfavourable. This is the course which we have taken. Having added the reasons for the practical reader to make needful differences, he will see in what cases he is to vary from the precise rule, and in what manner; but as to the degree of variation, that must be left to his prudence.

We have every where laid down the best precepts to the farmer, but we no where demand his exact adherence to them. The proper end of writing is not to take away the necessity of thinking, but to lead men to think, and dispose them into a proper road of it to advantage. Thus, in the present work, we deliver first the reasons of what we are about to advise; and afterwards give the directions with as much care and punctuality as we are able: but when the farmer has understood the one, and consider'd the other, let

let him put them in practice, according to the situation, nature, and circumstances of his own affairs, and of the land he tills.

C H A P. XLVI.

Of the quantity of seed to be sown in the common and drill husbandry.

THERE remains an important question, with respect to sowing, which is, the quantity of seed that in any kind is needful for a certain quantity of ground.

This is of great concern, because the price of the seed in some kinds is a considerable article, and because he may hurt his harvest, either by sowing a smaller quantity than the ground would be able to maintain, or a greater.

In the usual way of sowing by hand, there must be great uncertainty. One man's hand will be larger than another's; and yet the handful is a handful among the farmers in sowing.

The seed will be sometimes larger, and sometimes smaller: this will make a great difference in the number of grains in a handful, and the number is the only proper consideration in sowing.

If the field be but indifferently tilled, so that the earth lie in clods, and make the surface consist of hills and holes, the seed corn, though scattered ever so equally from the hand of the sower, will run off the surface of these clods into the holes; so that it will lie on the field very unequally: and in the same manner the crop will rise in clusters in some places, and be defective in others. This is a miserable fault, yet it is natural, and according to the common manner of sowing universal. Thus certain spots where the corn rises, are not able to support so many plants as grow on them, and others are vacant which would very well have fed the surplus. The benefits of the field are as unequally distributed among its growths; as those of fortune among mankind: there is enough for all if it were properly distributed, but millions starve because it is divided unequally.

This is unavoidable in the common method, but it is perfectly remedied by the drill husbandry. The seed there is spread just as intended, and the spaces left vacant are left as they may be most useful.

A larger quantity of seed than is needful for the crop, is necessary in the common method of sowing, because some

will be buried too deep, and some will be left too near the surface for shooting. A great deal that lies too naked will be eaten by birds; and upon all these considerations, reason prescribes to him who will sow his grain by hand, that he allow a great deal more than would be absolutely necessary for a crop.

This is a great expence if he allows it; and he defrauds himself if he denies it: at best the whole is an uncertainty. We shall teach him, by following the drill husbandry in a right way, to save this unnecessary charge, always to supply his ground properly, and always to distribute his seed equally.

His field shall have as many plants on it as it can support, and these shall have the advantage of every part of his soil. This is all that can be wished: this never can be obtain'd in the usual way of our old farmers; but however great a thing it may seem to promise, it will be perfectly fulfilled by the drill husbandry.

The seed by this method is let into trenches; these trenches are cut at the distance that is found best, and the seed is covered in them exactly so deep as it has before been found to require.

As this covering up of the seeds is done with a perfect regularity, every one is sure to be cover'd, so that none is devoured by birds. And finally, the instrument lodges in each trench the quantity of seed that is proper, and no more.

By means of the drill the seeds of all kinds are thus lodged in the earth at proper depths, and out of the way of insects, for the greatest devourers of this kind prey near the surface. The few who creep to any depth, and devour seeds, are the sources of the only accident to which those sown in this manner can be liable; so that we may, with this small exception, provided the seed have been good, answer for the growth of every grain.

Here is seen the necessity of that caution we have before directed in the choice of seed corn. As the drill distributes only so much as is necessary, and no more, the utmost care should be taken that this be all good: for by so much of it as is naught, by just so much will the quantity be too little for the ground.

Here the sowing by the gauge comes into the farmer's assistance.

He has bought his seed corn, and he has sown twenty grains of it in twenty holes, and cover'd them equally. They have

have all the same advantages, let him see whether they all come up, or how many are wanting. This will shew him the value of his seed : and let him proportion the quantity accordingly ; allowing so much more than what he need to have done if all were good, as will compensate for the defects at that account.

We do not pretend this is a punctually exact rule ; for out of every twenty grains there will not be just the same number of good and bad ; but it comes as near as any rule can ; and as near as it need.

The drill husbandry disposes the seeds in rows ; and the instruments suit this practice to the several occasions. Thus some are disposed in single rows, some in double, in some three or four rows are set together. Between these rows there are spaces of six, seven, or eight inches ; where there are several of them ; and there are larger intervals between one set of rows, and another in this case, and between the single rows, when they are sown single.

It will be found by these trials, that supposing the seed of equal goodness, much less is required in the drill husbandry than in the common. Not that so many plants will not be supported upon the same ground this way as the other ; a great many more will ripen thus than in the common method ; because of the regularity : for by the other the wind will dispose the seed differently ; or the harrow will draw it irregularly in clusters in some places from others. In these clusters, though many plants rise, few come to good, and the vacant spaces are useless.

In our way the corn grows regularly, therefore one stalk does not starve another ; and the vacant spaces may be tilled while the crop is growing.

A piece of land will support more plants, when they are thus set, than it can when they are scattered in a random way ; and if it raise fewer, yet these, from the great perfection in their growth, will produce more in their kind, because they are better supplied with nourishment ; for every particle of the ground is made to serve for nourishment.

Fifty seeds laid together in a hole in the place of one, will not produce so much as that one, when planted as it should be, and properly nourished. The number starve one another, and none come to good : on the contrary, a single grain of good wheat, properly sown and encouraged by tilling the earth about its roots while growing, will

yield a quantity of seed at harvest time, greater than we dare mention to those who have not try'd such experiments.

In the common way a great deal of the seed is buried without hope of recovery, and a great deal is lost by accidents.

Husbandmen have never examined with exactness, what is the proper quantity of seed for land; nor do they make any great difference between the quantity for an acre of rich, and that for an acre of poor ground.

It is to no purpose to over-load a poor soil; nor is there any worse practice, than not allowing plants enough to a rich ground.

C H A P. XLVII.

The practice in respect of quantity in different places.

IN some of our western counties the farmers sow eight bushels of barley on an acre. They do not consider the nature of the soil. If it be poor they give it the more dung; if rich the less serves; and the quantity of seed is the same.

Their practice is to plow the land only once, then they double dung it, and after this the seed is scatter'd by hand, and harrowed in.

As the land has lain some time after the plowing, and is grown hard, the harrow takes but little effect. In all probability three fourths of the seed never gets into the ground, so as to grow.

The event is answerable. If the summer prove dry, the harvest sometimes will not yield half the quantity that was sown: in the most favourable seasons they seldom get above four quarters to the acre. This is a poor encrease; but they go on satisfied: labour is cheap, and they live hard; and so they live at all they are contented. What a prodigious difference is there between this, and the husbandry of the new method. In which the seed all lies at the same depth, and that is the very depth experience has shewn to be the most favourable to its growth, none is buried, none is exposed; therefore no allowance in the quantity, is to be made upon those considerations. But as the fly will damage some seeds, and frosts may hurt others, allowance is to be made on those accounts, and no other.

Before the farmer determines his quantity of seed corn by the bushel or the pound, let him examine its size, for a great many more seeds will go to the same weight, or the

same measure, when they are smaller, than are requir'd when they are larger. This will deceive in sowing by the drill, as well as by hand, if care be not taken.

Let the farmer weigh an ounce of the seed, and count the number of grains in that quantity; then let him weigh a bushel, and computing by the number in the ounce, he will come near enough to the number that contains. When the number in a bushel is obtain'd, they may be proportion'd out by the rule of three, to the square feet in an acre.

This is a certain method of giving the right portion of seed to any quantity of ground. But in this the farmer is to consider at what distance he intends the rows shall stand; if he designs to plant in single rows, he is only to consider what is to be the measure of the intervals; if he design in double, treble, or more numerous rows, he is to compute what will be the space of the partitions, as well as intervals; for the more rows are planted, the more seed will be required.

Let him next examine what is the produce of one middle sized plant of the annual kind; and what is the produce of the best and largest of the perennial; for he may assure himself that a plant of the perennial kind will never fail of being brought to this its utmost perfection by the drill husbandry, connected, as it always should be, with the horseshoeing method.

Let the quantity of seed, according to the preceding directions, be proportion'd to the reasonable products. Perennials are best planted in single rows; and most of the annual kinds in multiplied rows, two, three, or more, according to their nature; in general the best procedure is in treble rows, the rows being seven inches distant, and the intervals between them five foot.

In many cases it is worth while soon after the plants are up, to thin them to a proper number, leaving the most thriving.

Let the farmer set some rows of the annual kind thicker than others, and see in the end whether they answer better or worse.

This is sending him to experience for his guide. No direction is so certain; and the best office we can do him is to direct his experience into the proper course.

C H A P. XLVIII.

*Of the advantages the drill husbandry receives from the
hoe plow.*

REASON dictates that the drill ought to distribute more or less seed in each trench, in proportion to the nature of the plant. Let us see how we can come at the knowledge on which this is to depend.

The nature of the plant ought to direct at what distance the seeds should be lodged; for this will be effected by the quantity allowed to the instrument: as will be seen when we speak of its structure. Let us observe what space a healthy plant of that kind, we are about to sow, occupies in its natural growth: when we know this, we are so to fit the drill that it shall leave such a space between seed and seed, supposing all to be good; or a proportioned space according to the degree of their faults.

We shall be surpris'd at first to see a piece of land sown by the drill, and intended to be horsehoed, because of the great quantity of vacant space. We might take this to be unoccupied land; but we should err, for on observing the growth of the plants, we shall see they acquire a perfection vastly greater than those of the same kinds in the common method; and this is altogether owing to those spaces. These intervals we find therefore do, in reality, furnish the plants in the rows with nourishment.

We find at harvest every single grain of wheat that has grown well, has produced from twenty to thirty stalks; whereas in the common husbandry, each grain generally produces only two or three. If these twenty or thirty additional stalks from each grain were distributed equally in the intervals, the whole ground would appear well covered. They are nourished as well in the rows, as they would be if thus distributed along the vacant ground; and therefore whatever be the appearance, the effect is equal.

Let us next examine the ears. Every one of these will be found larger and better fill'd in this than in the common way. Therefore as the number of stalks made the growth equal, the goodness of the ear will make the produce richer, and the harrowing more abundant.

This is plain reasoning: it is absolute fact, therefore why should not the farmer form his practice accordingly.

In the common way of sowing, the ground seems well
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covered with plants, but as all this number cannot find sufficient nourishment in the ground, and it is in that way impossible to supply them better by means of tillage, after they are risen; it follows that a great many of the plants die, and many of the others become weak, none wearing that healthy aspect which is seen in those of the other raising.

In this new way all the plants are healthy, and are supplied from time to time with nourishment, by tillage of the vacant land between. Their roots spread into that ground, and they are nourished by the dividing it. The strength and rich produce of these, though few in proportion, might well make up for the number of the other small languishing and half-nourished plants. Facts establish this truth: for upon the fairest trials, it has been found, that of two pieces of the same land, equal in size, and alike in every natural respect, the one being cultivated in the old way, and the other sowed by the drill, and horsehoed, the produce of the last has been three, four, or five times as great as that of the other.

The benefit of dressing land by tillage, while the crop is growing, extends to the very hedges. White thorn will grow four times as fast thus as in another place, and in an equal number of years will yield four times as much wood. This account has been carried farther in other places, I write what I have seen.

This can be owing to nothing but the advantage of stirring the ground.

In the hedges within the reach of this tillage, the branches not only grow sooner to a good size, but there are more of them. It is the same case as with the corn which rises with more numerous stalks.

Plowing about the roots of the hedges must cut off a great many of them; and it does the same with regard to the corn, for the roots of these rows of corn do at first spread themselves into a great part of the five foot intervals, and by the assistance of the hoe entirely. The instrument does cut the roots of the corn, and of the shrubs in the hedges; but from this there results nothing but advantage. The roots of trees are like the imaginary hydra, or the real polype, they grow the more for cutting; and the new ones are more proper to draw nourishment than the old. When a root is cut off, a number of new ones are produced from it if it be cover'd by earth, and if that earth be newly dug they spread more freely. Thus this cutting of the roots, in the breaking of
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the ground, does the greatest good, it gives the plants a thousand new mouths to feed by, and it spreads food before them all.

Thus much it is proper to say with respect to the great produce of the corn in the drill husbandry. There are those who drill their seeds without using the hoe plow, and they succeed better than those who follow the old way entirely; but the two methods are naturally connected, and they should not be separated. It is to the effect of the horsehoeing, in the intervals, that the vast increase from the drill husbandry proceeds.

C H A P. XLIX.

Of changing the seed.

WE have mentioned before a thing which it is necessary to speak of more largely here; this is, the changing the seed, or the sowing upon a piece of land the seed which has grown in another place, rather than what has been obtained from its own crop. We have mentioned the fact, we shall here enquire into the reasons.

Custom speaks strongly for it: and that not of one time or country, but of every place we know, and all times of which we have account. Flax ripens its seed very well here, but we import it from Flanders for sowing; and in France, where every thing favours the growth of that herb, they still import the seed from the same place whence we have it. When our people have ventured to sow the seed of their own growth, they have but poor advantages, compared with those from the foreign; and the French say the same.

Many other seeds are also constantly imported from different countries, though they ripen favourably with us in the same kinds, and the same advantage is found. Our farmers from year to year, in many places, change their seed corn, and they say they find the same benefit. If there were no apparent reason, the success would be sufficient to engage the farmer to adhere to the practice. But there are not wanting reasons which explain it; and we shall propose them.

With respect to importing seed of certain plants from particular countries, there may be this reason for the advantage, that plants thrive better in some climates than in others, and in some particular countries. Where they

thrive best they will ripen their seed more perfectly, and many plants will do this much better in their native country, than in any other.

A plant that does not thrive perfectly, will not yield perfect seeds, and seeds that are not perfect will not give plants that are. Every plant has its country, and there is this reason for finding where that is. We thus not only see the real benefit that follows this practice; but are directed to push it farther, and may thereby improve many other kinds.

Beside this difference arising from the climate in which the seeds have grown, they may be altered by the nature of the soil in the same country, and will be much better having been rais'd on one kind of land, than another. In a poor soil plants grow weak and low, they languish as they stand, and it is very natural to conclude, that as they are altogether weak, the seeds are so too. Imperfect plants will not produce such perfect seeds, as those would which are vigorous in the same country.

We have been careful in our directions to the farmer about trees, to chuse the seed cautiously himself, not to get it by purchase. We have advis'd him to gather it from a lively and well-growing tree. Every nurseryman knows seeds from poor trees produce poor ones again: and as this is a fact in the larger productions of this kind, why should it be doubted in the smaller.

Mr. Tull advises, that the seed for any piece of ground should be got from a land somewhat richer than itself, and from one that is well cultivated. This seems to contradict the doctrine of removing trees from a poorer soil to a richer in nurseries; and it might be retorted upon us, that this rule ought to hold in one instance as well as another. This seems an argument, and the opinion of many is against that we have adopted in this place; but upon the whole consideration it appears, that what this author advises is right. 'Tis the first shoot only that is regarded in corn, for that is an annual plant: this is certain to be stronger and bolder, from a stronger seed: and this is all the concern.

The farmer will hence learn the reasons for getting his seed corn from a better soil than his own; but we have observed, under the article of sowing, that it is advisable for him to change it also merely for the sake of changing; and even this practice, is not without its foundation in reason; nor does it want plain proofs of the advantage.

Weeds are a great trouble to the farmer in his corn lands, and there are some which love one soil, and some another. The seeds of some of these will be mixed among the corn, and therefore, as they will be sure to thrive on their favourite soil, the farmer when he sows his own corn upon the ground again, lays in a store of them with it. This is prevented by making an exchange with another, who cultivates a different kind of land. There will arise a great benefit to both by the exchange, supposing the corn equal in goodness.

Suppose one of these farmers cultivates a light sandy soil, and the other a tough clayey one. The seed corn from the sandy soil is full of the seeds of the corn marygold, and these being sown on the same sandy ground, would produce that weed innumerable; but being sown on clay they come to little. In the same manner the seeds of those weeds which love a tough clay, being sown among the seed corn on a light sandy land, seldom thrive. Thus each farmer gets rid of a great quantity of weeds by sowing the corn raised by the other: there is no disadvantage attending the crop itself, for wheat is wheat, whether it have grown on clay or in sand, and it will thrive in either if properly dress'd.

Mr. Tull thinks this changing of seed will not be necessary unless for getting of better, because his method of culture destroys weeds: it is true the horsehoeing husbandry does this; but there is no reason to say we need not change the seed, for the production of weeds is not the only mischief.

The grain of land cultivated by the drill plow and horsehoe, is fairer and finer than that of other ground; but we shall not, for that reason, advise the farmer to sow it over and over again upon the same piece: neither shall we advise him always to chuse the finest looking and biggest grain for seed. It is a material circumstance in the drill husbandry, that the seed be all nearly of the same size; but it is not needful that it be always large; for the soundness is a more material article. We find very small wheat, if sound and well conditioned, will produce very large and fine plants; and in this there is a plain advantage, for it goes so much farther in sowing, as there are more grains in the bushel.

CHAP. L.

Of the supposed change of species, and of Patney barley.

PLANTS of all kinds degenerate on soils not agreeable to their natures. They languish, whether the climate, or that the soil in the same climate, make the difference. The imagination of one plant's changing into another, because of the soil not agreeing with it, is idle and foolish. We no longer believe that wheat can change into rye, nor any of the like tales; but we see and know, that a plant which continues the same in kind, will be worse in quality, as the soil and climate are less suited to give it nourishment. This is degenerating, and this really happens. A grain of wheat, however managed, will never produce any thing but a stalk and ear of wheat; but when it is sown on a good soil, and well cultivated, it will raise a great number of stalks, all of which shall have full ears; whereas, when it is rais'd upon a poor and uncultivated ground, it shall have but one, and that worth little.

In the same manner that Redi proved the falsity of equivocal generation, may any one shew that of the opinion of wheat degenerating into rye, which is equally false, though it was at one time as universally believed as the other.

People saw maggots in meat, as soon as it began to stink, and they supposed they were bred from the meat. That ingenious Italian placed several pieces of meat to stink; some in open vessels, and others covered with gauze; the flies came to the open pots, and laid their eggs upon the meat, from which eggs came maggots, and they turned to flies like their parents; but the flies could not get at the meat that was covered, so that corrupted as well as the other, but no maggots bred in it.

The farmer sows wheat in his field, and he sees rye rise amongst it; he fancies some of the grains of wheat produc'd rye: but they were grains of rye among the wheat he sowed. Let him pick a quantity of grains of wheat out of the ear, and sow them upon bad ground, the plant will be poor, but they will be all wheat; and let him examine the wheat he buys for seed, in places where he is used to see rye among it, and he will find grains of rye in the parcel.

The whole amounts to this. Seeds of the several useful plants have been brought to their present condition by culture:

ture: and the plants which rise from them will answer, in all respects, while they are well cultivated also, to those which produced them. The cultivation consists in giving them good land, dressing it well, and planting them properly: 'twas this raised them to their good condition, and this alone can continue them in it. They are poorer in their state of nature, and they will, while they are neglected, be returning to that state again. This is called degenerating; but it is properly returning to their original condition: they grow poorer and worse, but they never alter in their kind.

The great article that promotes the successful growth of plants are two, heat and moisture. These differ in various climates, and in various soils. There may be as much variation of heat between a field of sand, and another of clay in the same county of England, as there is between countries distant by many degrees.

The effect of this is plain in what is called the change of kind among our grains.

We talk of Patney barley, otherwise call'd Rathripe barley, as if it were of a kind really different from common barley. It is the same in species, but the difference in its growth is very great, and by examining this we shall understand a great deal of this whole matter.

Patney is a town in Wiltshire, the fields about which are of a sandy soil. Sands are naturally hot; a parcel of common barley being sown in these fields, will ripen earlier than it would elsewhere: and the seed of this crop will keep that virtue three or four generations.

This seed, so rais'd from a parcel of common barley, is Patney barley, or Rathripe barley. Let it be sown on a light and tolerably warm soil, and it will ripen a fortnight or three weeks sooner than other barley; and the grain produced from it will have the same property for so many successions.

But let this be sown upon a clayey and cold land, and it will quickly yield common barley again.

Thus we may, at any time, make Patney barley out of common barley; and make common barley out of Patney barley again.

We shall add one caution to the practical farmer, which is, not to set such a high value upon this Patney barley as some do. The change may be useful on particular occasions, but it is in reality a change for the worse. Patney
barley

barley is shorter liv'd than the common ; and it is tenderer and weaker. The novelty recommended it, and fancy has kept it in use, but those who sow it, are in general losers.

If a small frost happen after the sowing, it generally destroys it : this is not common, because it is sown late : but it may happen ; and the mischief is great : if it have any check from cold winds, from an early drought, or any other accident, it does not recover as common barley will ; and at the best, if it be brought to a fair tryal, and a field of common barley, and another of this kind, be sown on the same day, and have equal advantages, the common barley will yield a much larger crop, though it be upon the ground somewhat longer.

C H A P. LI.

Of the effect of soils on the growth of plants.

THE soil in this case of Patney barley acts in the same manner as a different climate, changing as it were, for a time the nature of the grain ; and the same may be observed of all those other changes which afford the different kinds of seed, wheat and other corns, distinguished under a great variety of names.

The exposure may also act with the soil in this case. A sandy soil under a tolerable cover, will ripen any grain sooner a great deal, than a cold land exposed to the north. The same mountain in the east produces on the south side Indian plants, and on the north such as are common to Europe. When we understand the nature of these changes, we shall not be led into the common errors about them, which often mislead the farmer to his hurt. He who reads to learn, and form his practice according to reason, will therefore know how far he is to regard them, and how far to believe those who speak of them. As to these lesser changes, he sees to what they are owing ; and as to those of the varying one kind into another, they are false. What we have said of Patney barley may be applied to every other instance : though in some such a change is more worth his regard than in others ; because it is more useful.

The flax of Flanders is better than the flax of England : but the seed of Flanders flax sown here, will produce as good flax as there. The seed of that crop which has grown from the Flanders seed in England, produces a coarser flax,
and

and its seed a worse still, till we are necessitated to make a renewal.

This is owing to the difference of heat and moisture, not to the earthy matter, which is the immediate nourishment. That answers for the good growth as well in England as in Flanders, as is seen in the first crop; but it does not here arise to the full perfection of the seed: and this is owing to our country not suiting it in respect of heat and moisture.

This appears to be the case, but perhaps we lay that to the land, which is the fault of our people. Let them examine what is the soil on which they raise the finest flax in Flanders, and what is the management they give it. Let them fix upon the same soil, and treat it in the same manner here, and perhaps there will then be no need to send thither for seed. At least the seed of their flax will hold good through more generations.

We shall treat this subject more largely hereafter, under the article of flax: here we produce it only as an instance of these general truths.

It is plain that the nourishment of all plants is the same, and the only difference is, that some soils abound with it more than others; and some plants, according to their nature drain more than others. There is no plant but will, according to the vigour of its roots, rob such other plants as are near it: and a soil which is at one time proper for one kind of growth, will always be fit for it, if kept in the same heart by proper dressings.

This is contrary to common opinion, but it is not the less true: common opinion often errs.

On these facts depends that great improvement by the drill and horsehoeing method, which we are about to explain.

We have proved that the matter which nourishes all plants is the same; therefore, when a piece of ground is exhausted by wheat, there is no occasion to sow it with some other kind, supposing it has nourishment for that, although not for wheat. The better course is to dress it properly, and get it into heart for wheat again. This is easily done by the new method, without losing time by fallowing.

We have shewn how, by a proper management, a piece of ground planted with coppice wood, shall every year supply a felling; and we shall shew how a piece of ground dedicated to wheat, or any other corn, shall furnish him a good crop every year.

The advantage of changing crops is owing to the quantity

tity of the nourishing matter left in the ground by the first growth, the quantity required by the next crop, and the benefit by tillage.

This must be the case, because we see that all kinds of plants growing in the same soil, take in the same nourishment. Upon this principle we suppose instead of changing the crop, to improve the nature of the soil by more tillage; so that, instead of being in a condition to support only a poor crop, it may be able to nourish again one of the best kind.

BOOK VI. PART IV.

Of Drill and Horsehoeing Husbandry.

CHAP. LII.

Of the nature of drill and horsehoeing husbandry.

DRILL and horsehoeing husbandry are properly to be treated together, because they never succeed so well as when they are used together. Some have practised the drill method alone, and they have found advantage, because of its superior benefit; but they might have had much greater profit by using both together. We have informed the farmer so fully concerning the nature and growth of vegetables, that he will understand the manner in which this husbandry produces such excellence in all kinds of plants; and we may now proceed to shewing distinctly and exactly what it is.

Drill husbandry is the practice of the garden brought into the field; and horsehoeing, is that of the nursery employed in the service of corn. The practice of the garden is better than that of the field, only more expensive: there is therefore great merit in bringing it, so far as that can be done, into the field: and the same is the case with the operations of the nursery.

In the field, corn is scattered at random, and cover'd at different depths; in the garden seeds are set in regular trenches, and allowed to the same depth, and that adapted to their natures. In the drill husbandry the same is done in the field. A plow is used to this purpose, which makes trenches of a proper depth; the seeds are spread in due quantity in these, and covered equally in them, so that the practice of the garden is brought into the corn field, only in

a more exact manner : and the plowing, sowing, and harrowing, is all done at once.

When corn is sown in the common way, there is no meddling with the ground afterwards, because of its irregular growth ; so that the earth cannot be divided and broken to give it more nourishment ; nor can weeds be conveniently destroyed. But in the drill husbandry there may be left intervals between the rows, whether they be single or double, and these intervals, admitting the proper instruments, may be tilled so that new nourishment will be given to the roots, and weeds will be destroy'd : this is the practice of the nursery ; where young trees are planted in rows, with intervals between them ; and those intervals are, from time to time, dug up. This destroys all weeds, and at the same time breaking and dividing the soil, serves to create, as it were, new nourishment.

We have shewn in what manner the earth is, by this digging, prepared to give passage to roots ; and how those roots are multiplied by the cutting them off in the digging ; and the advantage so well known to attend digging between the rows, shews what was there advanced is true.

The same effect which digging takes in a nursery, it will take upon the crop in a field, whether corn, or of whatsoever kind, for the reason of the thing is the same in both cases, and what is thus founded on fact will never fail. We see here the practice so advantageous in the nursery, brought into the corn field ; and so well have the instruments been contrived by which it is performed, that the service of horses in drawing them, does as well as the labour of men's hands.

When the two methods of drill and horsehoeing husbandry are used together, the crop is planted regularly, and the ground is tilled while it is growing. The seeds are covered to a proper depth, they are proportioned to the quantity of ground, and as they come up the plants are fed by a continual new supply from frequent breaking of the ground.

CHAP. LIII,

Of drilling.

DRILLING, is disposing seeds regularly in rows, and covering them with a due quantity of earth. We have shewn how the just depth is to be found with gauges ;
and

and we shall describe the instrument by which it is performed. We here treat in general of the method.

The drill plow makes channels at regular distances, and of proper depths; it spreads the seeds in those channels, and it covers them up with earth.

The seed box is a part of the instrument: it performs the office of a hand in sowing the corn, but in a much better manner; for it numbers out the seeds as it receives them, and distributes them in the trench with exactness.

The disposition of plants in rows, has this benefit, that the crop comes up together, and 'tis scarce possible weeds can rise among it. The corn that is sown rises in lines, and the weeds in the intervals: however near they seldom are exactly in the line. This betrays weeds at once by their place, so that they may be taken up while young.

Charlock looks very like the turnip in its first rising; and there are several kinds of grass which are like the first shoots of corn. When these rise among those crops, they must stand till they are grown up to be discover'd; whereas, when the seed has been sown by the drill, we know if any thing rises out of the line it is not a part of the crop.

The drill husbandry at once places the seeds in such a manner, that they may have the greatest possible advantage; and betrays, at their very first shooting, those weeds which would have rob'd the crop of part of that nourishment.

It makes way for tilling the ground, while the crop is growing upon it, which is a vast advantage, and cannot be obtained by any other method.

There is thus an opportunity of destroying weeds at any growth, which could not be done if the corn were disposed in any other manner. Those useless plants which would have exhausted the nourishment, are torn up and buried in the earth, and becoming there, as they rot, a kind of manure, supply it with new nourishment.

CHAP. LIV.

Of horsehoeing.

THE advantages the earth receives from tillage are of two kinds, the destroying of weeds, and the breaking the soil. These cannot be obtained by any method so perfectly, as by horsehoeing; and therefore horsehoeing, husbandry is preferable to any other.

The plow prepares the ground, but it goes no farther; for

for it cannot be used in the common way, after the corn is up: but the crop may receive greater benefit from the tilling of the land while it is growing, than in the preparation.

When the earth is well prepared, it is broken and rendered loose, but from this time it naturally clods together, and grows compact. Plants require more nourishment when they are grown, than when they are very young; but in the common practice they have less: because the soil grows worse from the time of sowing. The horsehoe tills the land while the crop is growing; and by that means gives the plants a new supply, when they most want it.

Plowing and hoeing differ in this no more than by the form or shape of the instruments: a hoe may answer the use of a plow in breaking the ground before sowing; and a plow may be used, as it really is in this method, to tear up the weeds while the crop is on the ground. It is in the time of performing it, the work actually differs. As plowing is the preparing land for sowing of a crop, hoeing is the tilling it when that crop is growing.

If land be tilled ever so well before hand, that will not prevent the growth of weeds, for although all roots were destroy'd, seeds are continually brought by the wind, and the better the land is, the surer they will grow.

Those weeds which are most troublesome, have seeds winged with down, so that they fly to great distances. Of these kinds are thistles, coltsfoot, and others.

No care in tilling beforehand can defend against these; the fitter it is for the crop, the fitter it is also for them: therefore something is needful afterwards. The labour of weeders is expensive, and in the common way of sowing they cannot avoid damaging the crop. When the seed is drill'd it is easy to get between the rows, even with a large instrument, the advantage is evident; and the work cheaper.

We see the benefit herbs receive from transplanting, this arises from the cutting off the end of their roots; and placing them among new broken earth. This would be impossible in many cases; for who could think of transplanting a crop of corn; but the same advantage is given when it is planted in regular rows by the drill, and the earth is plowed up between by the hoe plow.

The advantages of hoeing a garden crop, are very great; and these are all communicated to a field of any useful growth, by the hoe plow, only in a more perfect manner.

Some who follow the new method rob themselves of half its benefit,

benefit, by their fear of setting about it with spirit. They drill their seeds in rows a foot and a half distance, and then cut up the earth lightly with a horse hoe between. This is of the nature of the garden hoeing, and is of great advantage: let it be done properly, and it will be of much greater.

Wheat should be drilled in treble rows, with partitions between each row of seven inches, and an interval of five foot between every three rows, and the next three: in this case the corn itself will prevent the growth of weeds in the partitions, and the soil in the intervals may be tilled deep with the hoe plow: the crop will thus be twice as good as in the other way.

CHAP. LV.

Of the benefits of deep hoeing.

THE shallow turning up the earth between the near rows, serves as hoeing in gardens, assisting the present crop, but it has no farther effect; the deep hoeing in the five foot interval, serves in the place of fallowing, and will often answer the purpose of manure; tho' on many occasions it will be worth his while to assist the crops by both means.

Hoeing in this deep and perfect manner keeps the earth always moist, and disposes it to receive dews and rains. The more land is tilled the more freely it receives these, and the more serviceable it makes them to the crop. A piece of hard land detains what falls upon it too long; and often this is so chilled that it hurts the growth. The fine and well tilled earth, as it receives the rains and dews, distributes the wet equally, and as it does double service, it never can do any harm.

Experience confirms the benefit of deep hoeing. If a piece of poor ground be sown with wheat, when the plants are yellow and sickly, let a part of the field near them be hoed in this manner, and they will revive immediately, and will continue to thrive in proportion as the practice is continued.

If the farmer expect the full advantage of hoeing, without any injury, he must prepare the ground by a thorough tillage beforehand: for when the ground is hard, as it will be when but half tilled, the hoe plow often breaks it up, or cracks it among the rows, if it be carried deep: but when the earth has been put into a good tilth before, there never comes

comes any harm of the deepest hoeing, for it all crumbles at the surface about the places where it is turned.

For the same reason that stirring the earth is useful in affording nourishment, the deeper that is perform'd, provided we do not go thro' the good soil, the more will be the advantage: for plants spread their roots and send them down to a certain degree at the same time; so that the intervals between two rows of corn, by being stir'd and broke to eight inches deep, afford a certain proportion of nourishment, which the corn would not otherwise have had. If the earth be stir'd to sixteen inches deep, provided it be good so far down, the plants will receive nourishment from it in a double proportion. This is the difference between that slight hoeing that is perform'd between the rows of a foot and half distance, and the deep hoeing between those where the interval is five or more feet.

This shews the propriety of leaving those wide intervals; and all must find it to their advantage to have such; but nothing is so difficult to conquer as prejudice.

A farmer, when directed to plant wheat in treble rows, likes that; but when we name a five foot interval, he starts at the thought of losing so much ground: but we shall shew him that there is no way in which the ground does so much service, or turns to so great account.

The drill plow may be so made as to sow many rows at a time, and those at small distances: but this is not the most profitable use of it. Some who are now introducing the drill husbandry without horsehoeing, call it an improvement; but they should be better inform'd. It was practised long before Mr. Tull, and he gave it up because he found it less profitable than the other. Drill husbandry and horsehoeing husbandry should never be separated; and to practise them to the best advantage, the rows that are sown by the drill should never be too near.

Some plants thrive best in single rows, with large intervals between: others do very well with three or four rows near together, and then a large interval. In this last case the rows should be seven inches distant from one another, and the intervals between one set and another, considerably broad.

When these three or four rows rise up to a small height, they blend at top, and make one broad row together. We call them altogether, a row, and when we speak of the intervals, we mean those between one set of these rows and another.

These are to be broader or narrower, according to the nature of the plants, the largest requiring them broadest.

Every row must have an empty space at least on one side, of two foot and a half broad for the smallest kinds, and for all corn five foot. Smaller intervals do in gardening, because the hand hoe only is used, and does not go deep; but when the hoe plow comes, and cuts up to such a depth, a larger space is required, because the roots of the crop will penetrate farther.

Although there be five foot spaces between the rows of wheat in an acre of ground, yet the stalks in those rows will be more in number, than there are usually upon an acre in the common way. And this shews that it is an error to imagine there is any real loss of ground by means of these intervals.

If the ears were equal in goodness, the crop would be equal, because there are the same number one way and another; but they are finer and better filled in the horsehoeing way, and therefore the produce is greater.

When these intervals have been horsehoed, the roots penetrate through them. Therefore the crop while it seems less is really greater than in the other way; and though part of the land seems unoccupied, every particle is occupied, for as the roots penetrate through the intervals, they also entirely spread over or fill them.

Many experiments have been made to determine the loss or gain by large intervals, and the result is, that the larger the intervals to a very considerable breadth, the greater is the crop.

In the same field wide intervals and narrow have been try'd, both without the assistance of dung; and in the other part dung has been used without hoeing. The result of such experiments must be conclusive; and it has appeared from these, that the dung'd part without hoeing, did not yield a crop nearly equal to the hoed part; and that the hoed part, where the intervals are widest, yielded the largest. Hoeing is preferable to dung, for it costs less, and produces more; and the wider the spaces the more benefit there is from it. These are general facts, but the farmer is not to determine his practice by them in every instance. We shall, on some occasions, advise him to have the intervals moderate, and on others to use manure with the hoeing.

CHAP. LVI.

Of the different appearance of crops.

CORN sown in the common way will make a better appearance at first, than that which is drilled; but it declines toward summer, as the other advances: and though the seed corn have been the same, and the land the same, the crop from the drilled and horsehoed, as observ'd before, will be vastly the larger.

When the intervals are wide, they may be horsehoed several times while the crop is growing: the plow may come pretty near the edges of the rows the first time, but not so near the second, and so on, till for the last time it must be carry'd only along the middle. The reason is, that it would else crack the ground too much in the rows, and break off too many of the largest roots.

It is to the advantage of plants, that the small roots should be broke off, but when they are grow to a size they will receive too much check by breaking off the larger; only the middle of the interval is to be broken up at that time; but even there, there will be small roots, which being broken off by the plow, will send out innumerable others into the earth thus prepared to receive them, and give them nourishment. So that reason shews this hoeing only in the middle of the interval vastly invigorates the plant.

This practice of hoeing will give more nourishment to a crop that has no other assistance, than the common method by dung; and so far is the land from being exhausted by this method, that the more successive crops are planted in a piece of ground, with wide intervals, and well hoed, the more able it is to maintain them. The last crop is better than the former, and this without dung, or fallow.

The crop need not be chang'd as in other husbandry, for in this case the ground does not grow poorer, but becomes richer every year.

When ground is prepared by dung, it bears wheat the first year, but the next crop must be of an inferior kind, because the soil is growing worse. But the ground is growing better continually, by this method of horsehoeing, and consequently wheat will grow on it every year.

If there were to be any change in fields thus tilled, the first crop should be the poorest, and the farmer should rise to better every year, till at last he come to wheat: but it may

be prepared for wheat at first, and will continue fit for it throughout.

The wider the intervals, the more the earth may be divided. There is not room to turn two clean furrows in an interval that is narrower than four foot eight inches. If any one should attempt it in a smaller interval, he would throw one of the furrows, if not both, upon the next row. Such plants as grown saintfoin, and the like, that can bear to have the earth drawn off of them by harrows, may endure this, but even they will be the worse for it.

The farmer is to suit his practice to his situation; let him not therefore be tempted to follow this method against all other measures, in every situation. If he have a dry and brittle land, on a level situation, he is best suited for it, for it is with such ground it best agrees. If he have tough heavy clays let him first improve them well with sand, and then use the horsehoeing husbandry; and if he have lands upon the steep descent of hills, let him then follow the old method; for they are not suited to this practice. In common fields, as the custom stands at present, he cannot well follow this method: but we hope we shall see this objection daily diminish.

This method of husbandry has been adopted in France, and has been found greatly preferable to the common practice; and as the farmer's profits are so low that the rents in most places are ill paid, and the farms continually thrown up, is it not greatly to be wish'd that an improvement invented in our own country, should also be followed in it, while we see others enriched by using it, and ourselves impoverished by the common methods? The legislature has interfered to introduce broad wheels, how much is it to be wish'd, that the same could be obtained in respect to this practice, the consequence of which must be much more beneficial.

The objection of using this improvement in common fields, holds good against any other. We have found the advantage of raising what are called the artificial grasses, saintfoin, lucerne, and the like. But this cannot be practised in common fields, because people must observe the same turns of plowing and fallowing with others. The interposition of the legislature is wanted for the encouragement of husbandry.

Having laid down the advantages of the drill and of the horsehoeing husbandry, and shewn why they should be used together,

together, we shall explain the instruments employed in this practice, and then proceed to the mannner of using them..

C H A P. LVII.

Of drill boxes.

IN drill husbandry an instrument is used which performs at once the several operations of opening the trenches, disposing the seed, and covering it up. The first part is performed by a plow, the second by the drill box and the third by the harrow all united.

The plow has its shares disposed to cut the trenches of a proper depth, at regular distances, and in a certain number; the drill box lays in the seeds, and the harrow covers them. These three parts compose one instrument. The harrow we have named among the other implements of that title, and we shall hereafter treat of it more largely, as also of the plow: the present business is to consider the structure of the middle part, the drill box, which is the material article.

The whole instrument consists of the plow and harrow, the seed box and hopper: the seed box receives the corn from the hopper, and delivers it into the trenches.

The mortise is a very material part of this implement, and it differs from a common mortise, in that it is impossible, from its shape, to fit it with a tenon, being narrower above, and shorter below; all this will be represented in the figures.

A multitude of words might be used to describe this, and the other parts of a drill box, but the assistance of the plates will spare them. It is sufficient if we can convey such an idea of them that the farmer will be able to understand them, when we have occasion to mention them, and the workman to make them, and to compose the whole.

This mortise being understood, we shall consider its use in the drill box, and thence the other part of that machine. Let us suppose it a seed box for turnips, it will appear as represented in the figure under that name. The reader will there see the upper and lower edges, and the manner in which they are placed over one another. We shew the top of the mortise, and the bottom with the lower edges.

We have represented in another figure, this essential part, the mortise cut through and laid open. It is shewn as cut down by its four corners. If the opposite sides and ends were all raised up, the mortise would be formed. A

great deal of care must be taken in making this true, for upon that the success of the whole instrument depends.

We have added after this the mortise of a wheat drill, in order to shew that very essential part the box, or great hole, which being larger is best shewn in the side of that kind. This perforation is the section of a cylinder that passes through the mortise.

We have represented in another figure, the tongue of the seed box, which in some degree resembles the tongue of the sound board of an organ; but it differs, as is evident, in shape, in situation, and in the manner of its being fixed to the mortise. The breadth of this tongue must be conformed to the breadth of the mortise and its bevel. The length of it must be such that it will reach lower than just to touch the bottom of the great hole.

If the tongue have too much play, the seed is apt to be turned out irregularly.

We have next given the figure of the steel spring in a turnip seed box, which serves both for a tongue and a spring.

The setting screw is another very material part of this instrument, we have therefore represented this plainly and separately. It must be of iron, and it is to pass through the hole in the fore end of the mortise.

We have next represented a notch of the spindle, with its ends near it. And we have next given the fore end of a wheat mortise, with its hole through which the setting screw is screwed: and after this the hinder end.

These are the principal parts, which the workman will easily understand; and which we have named and figured, because we shall naturally speak of them in the course of the work. Having thus represented them separate, we have given after them the wheat seed box entire, with all its parts and appurtenances: it is there represented as standing on its bottom; and the reader will easily distinguish its cover, which should be of brass, and the tongue hanging upon its axis, the end of the iron screw, and the notches of the spindle. This spindle is kept from moving endways by wreaths, in the same manner as the axis of a wheel-barrow.

We have next represented the outside of one half of the brass seed box: and after that one half of a brass turnip seed box, lying with its inside uppermost; and afterwards the whole. And we have there given the spring cover and the setting screw separate: we have afterwards shewn the counter screw

screw and the brass spindle, in which place we have represented the manner of its turning.

In these figures we have endeavoured to explain what is meant by the seed box, and its several parts, as they may be named separately or entire in the succeeding chapters. The workman will have a general idea from them, and if he have been accustomed to things of that kind, will not find it difficult to execute one from these parts seen distinctly, and the view of the whole. But as the greatest nicety and delicacy is required in the constructing those several portions, and putting them together; we would advise the workman who has never made one, to refer himself to the several cautions and directions given at large by Mr. Tull, in his horschoeing husbandry; we write to inform the farmer, not the mechanick, and must not trespass too far upon the plan we have laid down to ourselves in the first setting out of our work. We cannot, within the compass of our intention, expatiate farther on the structure of this instrument, but hope the figures, which save so many words in the description, will be sufficient for the purposes to which they were introduced.

C H A P. LVIII.

Of the wheat drill, and turnip drill.

HAVING described the seed box, we shall now shew its use, and the manner of connecting it with the plow, hopper, and harrow: first instancing their particular structure as appropriated to the sowing of wheat.

We have represented this instrument entire in a figure; where the situation of the seed box last described, and of the harrow mentioned in a preceeding chapter, are explained to the eye, and their uses evidently shewn.

The plow represented there, is calculated for drilling wheat in treble rows. These rows are placed at seven inches distance, and the harrow which moves on its beams covers the seed in the same operation.

The plank represented in the center of the figure, should be, for this purpose, three foot and a half long, eight inches and a half broad, and one inch and a quarter thick. And its upper and under surfaces must be true planes. The two beams of the plow are to stand directly under the plank, and must be held up to it by screws with nuts. These are to be two foot four inches long, two inches and three quarters

broad, and two inches and a quarter deep.

This plow makes its channels by means of three sheets, which have their shares and trunks. The first or foremost of these stands under the middle of the plank, and to shew its proper structure we have added a figure of it separately. It is placed obliquely, and pointing forwards in the plow, that it may be out of the way of the funnel. It should be an inch thick on the upper part, but the rest of it need be no more than the thickness of the share. We have represented also a share lying bottom upwards; also separately on one side of the trunk, which is a thin plate of iron, and is very well made out of the blade of an old scythe: this is to be riveted on to one side of the sheat. And after this the trunk entire, which is formed by this plate, and such another on the opposite side.

After this we have represented separately one of the hinder sheats.

The figure of this cannot be mistaken, and its situation in the plow is at one of the beams, as the other is at the other. They are both fastened into the beams by their tenons, which are driven into a mortise made for that purpose, and fastened by a pin passing through the beam,

The figure will shew the workman how to make these, but it may be proper to caution him not to make the tenons across the grain of the wood; but to chuse for this purpose a crooked piece of timber.

These things being understood, of the parts and their structure, we may continue the consideration of the plow as represented together. The fore sheat being fixed up at equal distance from each end of the plank, and as near as can be to its hinder edges, the funnel has room to stand with the fore side of its hole to make one surface with the back of the sheat, and the hinder part of the trunk does not reach the edge of the plank. The fore-standard must stand perpendicular to the plank across the tenon of the sheat.

The standard being thus close to the fore side of the fore hopper, there must be so much room between it and the hole of the funnel, that the seed may drop from the seed box into the middle of this hole.

The two hinder sheats must be placed at equal distance from the sides of the beams, and so near to their hinder ends, that there may be room to make the funnels in them, and there tenons to come up between their respective funnels and standards; these standards also must be set perpendicular

pendicular to the beams. The beams must be placed at such distance from one another, that the shares may be fifteen inches asunder, from the inside of one to the outside of the other; and the shares must be all parallel to one another, and to the beams.

This being the structure of the drill plow, the channel or trench that is made by the middle, or fore share or sheat, being at an equal distance from the two hinder sheats, is filled up, and the seed is covered in it by them; and the seed in the trenches made by the two hinder sheats, is covered by the harrow, which is fastened to the beams of the plow, and has two tines placed just at a right distance for that purpose: of this we need not give a farther description. Its figure and situation behind the plow represent it sufficiently, and we have had occasion to describe it before, among the other kinds of harrows.

The funnel rises two inches at the edges from the surface of the plank, and is five inches square at the top; and its hole at the bottom is continued quite through the plank, into the trunk that is underneath; this hole is square. Its opening for wheat and other grain, is to be three quarters of an inch; but when pease, oats, or other large seeds, it may be made an inch square, and it is to be a little wider at the bottom than the top. The other funnels are to be made exactly like this. They cannot be so deep because they are cut in the very beams, but their width at top is encreased by adding on each side a piece of wood, so that they are each an inch and quarter wider than the breadth of the beam. The upper or fore side of these trenches must not rise so slanting as the others, because that would bring them too near the tensions of the sheats.

Across the plank of this plow, near its edges, there lie two pieces of wood: these are each eleven inches long, two inches broad, and two thick. They are fastened by screws and nuts, and stand parallel to the other beams. Each of these have a double standard or fork, perpendicular to the plank, and by these standards the fore hopper is drawn and guided.

Having thus examined the make of the plow itself, which could not be so well comprehended in a figure, if drawn entire with its hopper, we have represented it again in that perfect condition, fully fitted up, and ready for work. In this and the other figure seen together, all the parts may be very plainly distinguished.

The

The fore standard, which rises from the front of the plank, is to be two foot long. Its breadth is to be two inches in the narrowest part, and it is to be half an inch thick in the thinnest, and two inches at its shoulders above the plank. We have represented it separately, and it will be so seen in what manner it is pinn'd thro' the plank before the funnel. It holds the fore hopper from turning upon the spindle. It is put thro' a carrier like that of a door latch, which is nailed on the upper part of the fore side of the fore hopper. In this the standard has room to play, or move sideways, that either wheel may rise up.

We have represented separately also a hinder standard, which being placed perpendicularly in the beam, is fixed in a mortise, and pinn'd into the beam. It has a shoulder behind, another before, and a third on its outside, and these serve instead of braces to keep it from moving backwards, forwards, or outwards. This is two foot four inches long, two inches broad, and an inch thick.

The two hinder standards are made just alike except for their opposite situation, their use is to guide, draw, and hold up the higher hoppers, which are represented in the figure where this plow is shewn compleat, in their places. They are to stand upright, and in the middle of the beams, and at such distance before the funnels, that when the fore side of the hopper, by its whole length, bears against the hinder surface of the standards, the feed may drop into the middle of both funnels.

The shafts are represented in both figures, they are to be fix'd down to the plank, each by two screws and nuts, and they are kept at a due distance by the cross bar, which runs from one of them to the other, at a small distance from the plank. These shafts must be so placed that the path of the horse is strait with the center of the plow, and then it will follow in the direct line.

The use of the trunks of this instrument is for making the channels narrow. Without trunks these channels must be made with ground wrests, which spreads the sides of them wide; but these trunks make them narrow of whatever depth.

We have represented separately one end of a hinder hopper laid open, the middle part is cut out to give a closer sight of the plow and fore hopper. The whole hopper is represented also separate and entire; as also a hopper with its standard, spindle, and seed box. By these figures the entire

mechanism

mechanism of this instrument will be understood. At the bottom is seen one end of the spindle passing through the hopper and seed box.

The bottom board of this hopper, which holds the brass seed box, should be four inches broad, and full half an inch thick. And at each end it must be a quarter of an inch longer than the seed box. We have also represented separately the two sorts of wreaths, which are screwed upon the spindle to keep it from moving towards either end, as well as to hold the hoppers in their places, one kind may be made of wood, the other must be of brass, and is greatly preferable in all respects.

When the plow is all together, as in the figure where it is represented entire, the fore hopper shews itself very distinctly; it is seen with its seed box standing on the fore funnel: this is larger than the hinder hoppers, but there is no more than the same quantity of seed to be put into it, when it is used.

As to the wheels of this plow, the diameter of the fore ones is to be thirty inches, and that of the hinder ones twenty-two; and their spokes are to be made strait, so that they are not hollowed in the manner of other wheels.

Thus have we represented to the eye this complicated instrument, and explained its parts by plain words. A volume might be written upon it; but by this the farmer will understand enough of its operations, and the plow-wright of its form.

This is the drill for wheat, and the little variations necessary to be made in it for other seeds will easily be comprehended. However, we have added the figure of the drill plow for turnips, that the general difference may be seen. The funnel, sheat, share, and trunk, which are the essential parts for the work, are the same as in the wheat drill already described, with very little variation; and the instrument is the less complicated, because it is to sow but one row, not three at a time, as is done in wheat, which made the necessity of three hoppers, and, in a manner, of a treble apparatus, which is in this case single.

He who understands the more complicated kind, will find no difficulty in comprehending every part of this, the principal difference of which is, that it is single. The shafts in this are to be light, and the bar is to be about three inches distant from the plank. The plank should be two foot and an inch long, five inches broad, and an inch and quarter thick;

thick; and the two pair of standards placed into the plank, with shoulders above, are to be thirteen inches high above it. The beam of the plow is to be two foot two inches and a half long, four inches broad, and two inches thick. The funnel is to be two inches deep, and four inches square at the top. The harrow follows in its place, and the tines are made of wood: and they are to stand eight inches asunder at their points, and six inches and a quarter at their upper parts, just under the harrow head. The hopper of the turnip drill consists of a box placed into the middle of a carriage, we have represented this separate, that its figure may be more distinctly understood, and afterwards the carriage in the middle of which it is placed. The circles of the wheels of this hopper go five and twenty inches asunder.

The double standards are used on a level, and not otherwise. We have therefore added another figure of the turnip drill plow, entire and fit for working without them.

C H A P. LIX.

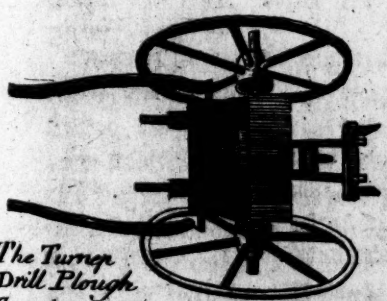
Of the hoe plow.

THE description of the instruments will appear tedious to some, and that it will be said, as there are people who know how to make them, why should their parts be enumerated here. Others have bestowed many sheets upon them, where we have comprised what we thought needful in a few pages. But something beside the bare figures we have thought necessary, because we would have every farmer entertain a general knowledge of their nature; and because we otherwise should not have been understood, when we come to name their parts, in treating of the manner of using them.

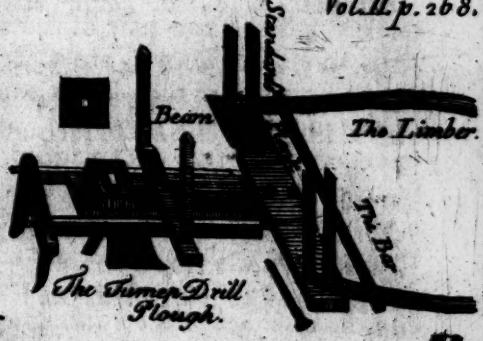
We have gone through the most complicated, and longest detail; the reader will give us his farther indulgence while we explain, in very few words, the hoe plow, or horse-hoe, which is an instrument much less compounded, and much easier understood.

We have given a figure of the hoe plow entire, and the reader who is already acquainted with the structure of a common plow, and the names and uses of its several parts, will be at no loss to understand this.

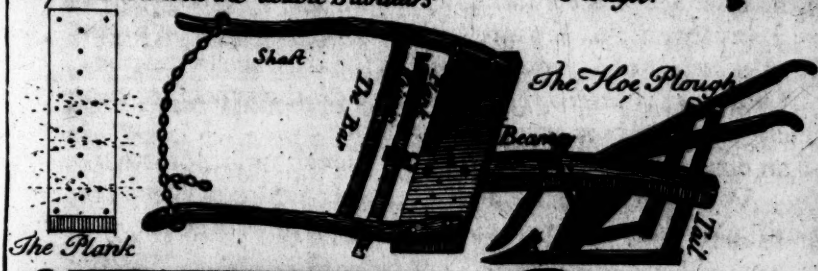
The beam and tail are very like those of the common plow. Indeed the resemblance is great, that the beam of a common plow being cut off, and screwed up to the plank



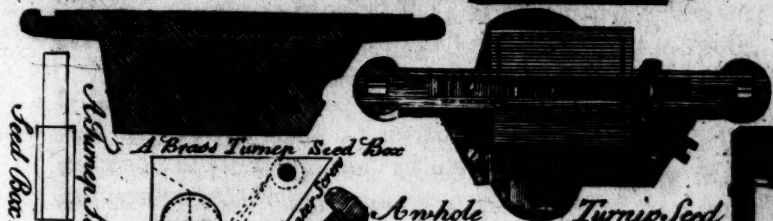
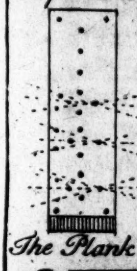
The Turner Drill Plough
Complete without the double Standards



The Turner Drill Plough.



The Hoe Plough

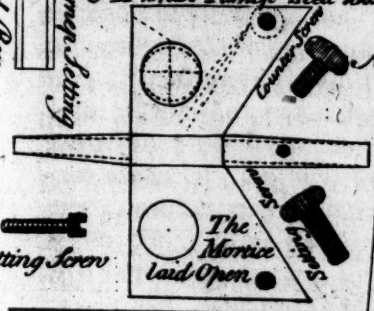


A Brass Turner Seed Box

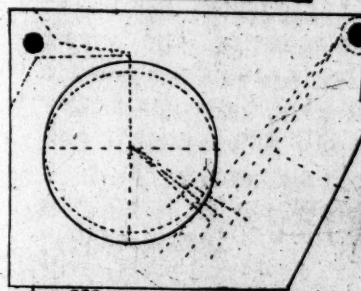


A whole

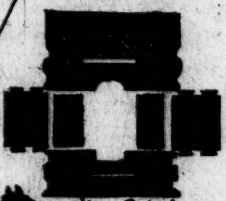
Turnip Seed Box



The Mortice laid Open

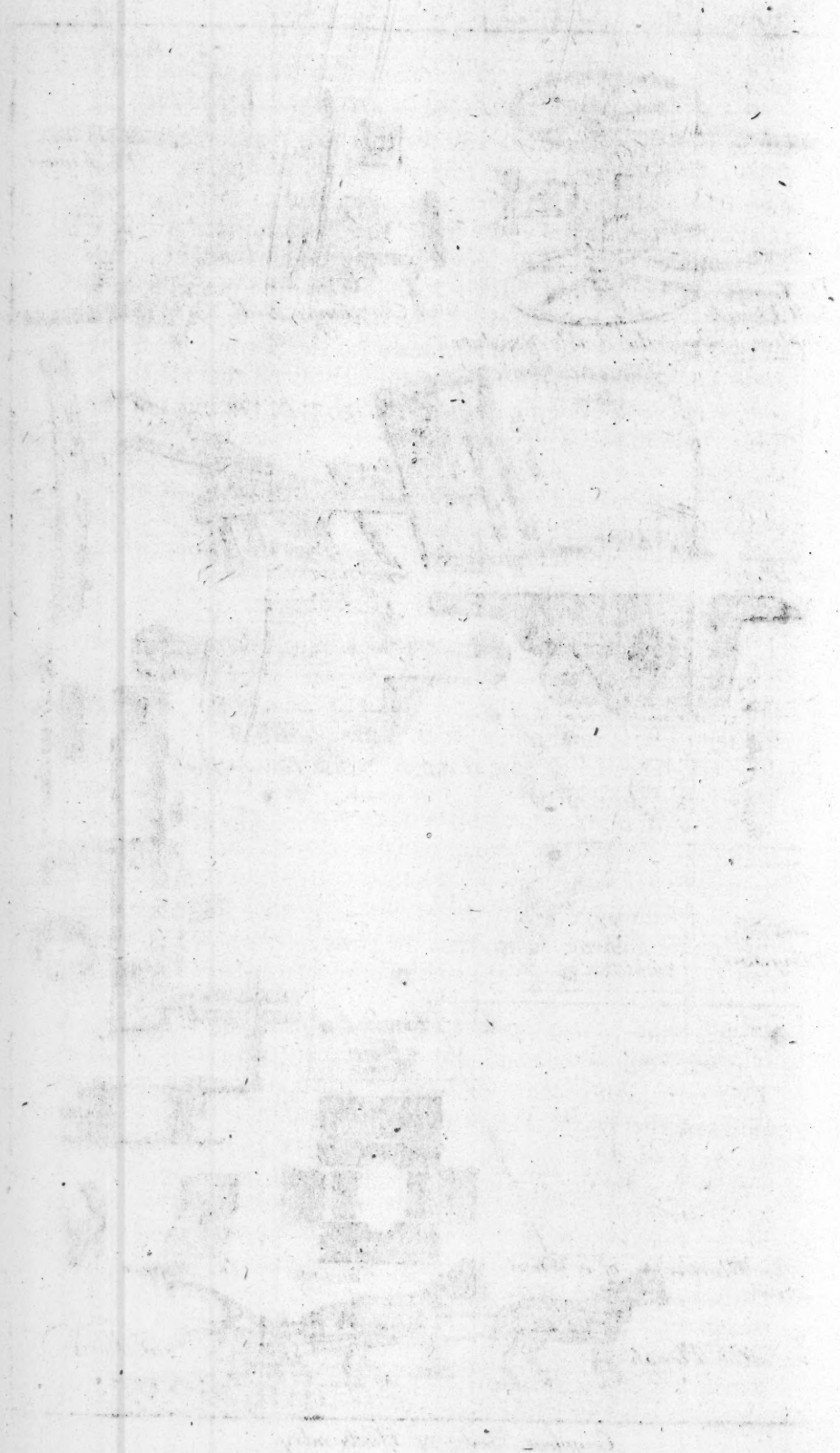


The Mortice of a Wheel Drill



The Stopper





plank of this, with its shafts tight, make a good hoe plow.

But to make a hoe plow perfectly and properly, it is better to set about it entire, and for that single purpose. The share, from its tail to the fore part of its socket, should be two foot and one inch long, and from thence to the end of the point, ten inches and a half: this is the proper measure of its under side. The length of the plank should be two foot seven inches and a half; it should be nine inches broad, and two and a half thick. The shafts are to be screw'd to the plank, in the same manner with the beam. And the draw pin, whose nut is seen in the center of the plank, is to have a crook underneath, to which one of the links of the short chain of the whipper is fastened. The under surface of the shafts runs on a level with the plank, and they are to crook outwards till they come within a foot of the chain; these shafts must be strong and well made. The notches in the ends of the whipper, serve to fasten the traces of the horses. And the shorter the shafts are from the bar the better, so they are sufficient in length for their purpose.

This plow is a very plain and very excellent instrument. It is set to go deeper or shallower, by changing the links of the chain of the shaft which lay hold of the crook. This has the same effect in the hoe plow, as the changing the pins to different holes of the crow staves in a common plow. We have represented separately the beam, with its mortise and holes; and the plank which, by its holes and dotted lines, shews the different manner of placing the beam. The four holes near the ends, are for screwing down the shafts.

There are usually nine holes in the plank, for changing this situation of the beam, that the plow may follow in a right path. The holder may also make some alteration in the going of the plow by the handles.

After thus representing the instrument, we have shewn it at work, where the manner of fixing the horses is seen. This instrument being explained, we shall enter upon its use, together with that of the drills before described; that is, we shall enter on the practice of drill and horseshoeing husbandry, for the service of which these instruments have been invented.

BOOK VI. PART VI.

*The Benefit of Drill and Horsehoeing Husbandry,
shewn in three Sorts of Crops.*

C H A P. LX.

Of raising turnips by the drill and horsehoeing husbandry.

WE have laid down the theory of drill and horsehoeing husbandry, and describ'd the instruments; and we shall in this and the two succeeding chapters, reduce that theory to practice.

We chuse for instances turnips, wheat, and saintfoin: the most useful roots, the most valuable corn, and the finest of the artificial grasses.

Each of these we shall mention separately on this occasion, and they are to be treated of more generally in a succeeding part of our work: they are here considered only as instances by which to shew the practice of this particular husbandry.

Turnips are distinguished by different names, according to their shape and colour; the principal sorts the farmer is to do with are three, the common round turnip, the long, or Suffolk turnip, and the yellow turnip.

These are for the food of cattle; and though it is but of late this root is got generally into the field, the advantage of cultivating it is so well known, that there is no article better worth the farmer's regard; and there is nothing in which he may have more benefit from the new husbandry.

Turnips thrive best in a light warm soil: and this kind of husbandry, is on such land best practised. The common method is to allow two pounds of seed to an acre, and to sprinkle it by hand.

They are sown at two seasons. In spring to produce seed the same year; and at midsummer for the food of cattle in winter.

Those sown for seed are few. A part of this is used for sowing again, and the rest is mixed with cole-seed to make oil.

For the midsummer sowing, the land is to be plowed in May, and twyfallowed in June: the seed is then to be harrowed in. Thus they are raised in the common method,

and are ready for the cattle in the depth of winter, and the beginning of spring.

This way they are very liable to be devoured by the fly, and the ground is to be often sown over again.

When they come up too thick, the practice is to thin them with a hand hoe.

This is the common way for raising of turnips, but it is subject to many inconveniences: we shall now shew the method by the drill and horsehoe.

That the farmer who shall try this method may give it fair play, let him fix upon a proper soil. The most favourable land is light, sandy, warm, and a little moist. The worst is chalk; but with good culture they may be raised any where. If the soil be shallow, neither turnips, carrots, nor any other large-rooted plants, will succeed well.

When a piece of ground is intended for turnips, it should be first plowed up as deep as possible, and then thoroughly broken and divided. If the soil be light, this will do; but if it be a tough piece of land, other methods are to be used; for unless it be broke effectually, so that it may be kept fine, the turnip will never arrive at perfection.

Those who would have tillage answer the place of manures, recommend nothing more than thorough breaking the land by working: we do not write to serve a system, but to serve the farmer. Therefore although we are, in this place, recommending the horsehoeing husbandry, and proposing the excellence of it in raising of turnips, yet we shall advise the husbandman to add, in case of a tough soil, the benefit of manures.

Let him lay on these as has been directed. And when he has thus converted a heavy soil into a light one, let him go to work upon it for turnips with the horsehoeing tools.

Suppose a farmer has a necessity of raising turnips, and has nothing but a clayey soil: turnips will not thrive upon it, because it is cold and tough. Let him therefore throw on good river sand: this will make it a kind of loam, in which state it will be lighter and dryer; and when he has made this change, let him go to work and prepare it for his turnips. The horsehoeing husbandry, with the assistance of this manure will produce them in great perfection. Whereas it would have done it but poorly without.

Other soils have a necessity of other manures, and let the farmer act accordingly. Let him first improve the ground, and proceed to the preparing it for this particular growth.

The

The success of his turnips will make ample amends for all his trouble and expence.

The season of sowing turnips for winter service, is from the end of May, to the beginning of August. The warmer the soil the later they may be sown.

The disadvantage of chalky soils for turnips is, that they grow slowly: and this, in their first stage, is destructive. The turnip, before it gets its rough leaves, is a prey to many insects; and as it is longer in chalky soils than in others before it gets them, there is the more danger. This plant grows much quicker in the new method than in the old, and therefore it is one of those that have the most benefits from it.

Sandy soils being warm make turnips grow fast, and the horsehoeing makes the earth receive the dews plentifully, so that they are always in a condition of growing with vigour.

In the new method an ounce of seed sows as much land as a pound in the ordinary way. In that way the turnips rising at random are, in a great measure, to be cut up, but in this all the seed that is sown is for good.

C H A P. LXI.

Of the disposition of a turnip crop.

THE turnip should be sown by the drill plow in single rows. And the best distance for these rows is six feet asunder. These large intervals will appear a great deal of waste ground, but the turnips have really the advantage of it all; and they will evidence it by their growth.

Turnips have been tried in double rows, but they do not succeed so well. Mr. Tull also sowed them in single rows, with three foot intervals, but that did not answer. He found a field sowed thus, produced a much larger quantity of turnips than a neighbouring one of the same extent, which was sown and hoed in the usual way; but its produce was not comparable to that of the single rows, with six foot intervals. When these intervals are well wrought by the horsehoe, to a good depth, the plants grow in a surprising manner, and never suffer by drought.

In Languedoc they have only four foot intervals between their rows of vines, and they break the earth between with a hoe plow drawn by oxen. This has led them in that country, where they very much use the horsehoeing husbandry

at present, to make the intervals among turnips of the same breadth: but their turnips, by their own account, have not come up nearly to the size and perfection of those raised in England.

As the season promises to be dry or wet, the seed should be let into the ground at a greater or lesser depth. When there follow showers the seed will grow, though but just covered with mould; but in a dry season nothing assists the shooting so much as lying at some depth, because there the seed is in the way of some moisture, that part of the earth never being so burnt up as the surface.

A great advantage of the drill method is, that the seeds may be let into the trenches at different depths, so that whatever be the season some will rise. When the seeds are lodged alternately shallower and deeper, if there follow rains, the shallow seed is the first that shoots; but if it be dry weather, that is up first which lies the deepest.

There is a great advantage in having two shootings of the turnips in the same field: no plant is so liable to accidents when young, and by this means, if one crop should be destroyed, there is another safe; perhaps without the trouble of a fresh sowing.

The same advantage may be obtained by sowing a mixture of old and new seed, for the old is longer before it comes up than the new.

The creature that does the mischief is a small fly. This comes in innumerable multitudes, and wherever the swarm settle they eat away down to the root. When they have done this mischief they go away, and it is perfect chance whether they come again just at the rising of the second crop.

It is only while the turnip is very young that it is liable to this mischief, and there is no probability that two swarms of these creatures should come each just at the time when there is danger. If they keep away till the rough leaves appear, the crop is safe; and this, according to the present method, is in a very little time.

When the season is favourable, when all the seeds have shot, and no mischief has been done by insects, the number of plants will be too great. And they must be thinn'd.

The sooner this is done the better. The method is to pull up the worst where they stand thick.

The quantity to be pulled up, will be determined by the

number that have risen. The turnips should stand at about ten inches distance.

When the turnips have some bigness in leaf, the hoe plow is to be brought in to the intervals. They may be wrought two and two if the crop grow well. This gives them their food from the new broken earth moderately, from time to time, and it is better than to give them a great deal at once, and then leave them a long while without any refreshment. This alternate plowing of the intervals is best for plants, sowed in single rows. But it does not destroy the weeds so well as plowing all in a regular manner, and at once. Therefore when weeds are very rank that method is preferable.

CHAP. LXII.

Directions for horsehoeing of turnips.

IT is a great advantage to make the plow come near the rows without damaging them: and this may be done much closer when they are young than afterwards; when they are hoe plow'd afterwards, and some earth is necessarily left near the rows unbroken, a man should be employed to go and turn that by hand, with a hook or some other instrument. The loosening the rest of the ground will make this break so easily, that a good labourer will do a great deal in a day: this is a much better method than to bring the hoe plow near them when large.

For many plants, when drilled in single rows, the method of working the intervals alternately is right, and where the weeds do not make the other method necessary, it is very eligible. Two plowings in this manner are only the expence of one, and the benefit is commonly sufficient. The plant that has abundant nourishment from one side, may dispense with its being more sparing on the other; and there are other reasons yet for this practice. If the plow, by coming very near the plants, have cut and broke too many of their large roots, the hurt is only on one side, and those on the other side will take in a sufficient supply of nourishment, till new ones are pushed out there in the place of others. The ground being firmer, we may, in that case, carry the plow nearer to the turnips without danger of loosening them; and finally, when the crop is large the plow goes more readily to the supply of first one parcel and then another:

another : and if all have less nourishment at a time, none are long neglected.

While turnips are small, care must be taken that a furrow is not left open near them, because the earth would become too dry; but when they have three months growth, there is no more hazard, because they are grown stronger, and the earth naturally becomes more moist. When frosts set in, the same caution should be observed, not to leave a furrow open near them.

The season in which they are sowed will, in some measure, determine whether the intervals are to be plowed alternately or otherwise. If the turnips have been sown late this method will do, but if early the weeds will grow fast, and the plowing them all in a regular manner will be necessary.

It is surprising to what a bigness turnips will grow by this method. Seven or eight pound weight is not an uncommon thing for a whole field, one with another; and in very good land, when the whole practice has been rightly conducted, 'tis common to see them of fifteen pound weight singly.

The great use of field turnips is to supply the cattle with food in the depth of winter, and in spring, till the grass gets some strength. As they are only pulled up as they are wanted, they often must stand till the season of sowing corn is advanced too far, or is absolutely over. This is a reasonable, and great objection against the turnip in the common way, but in this method of the horsehoeing husbandry it is none. The ground in the intervals may be sown; the turnips may stand, and they will get nothing but advantage from the repeated tillage of the ground between.

The plowing for the sake of the turnips, keeps the intervals in order, and they may be sown in the middle with corn in treble rows, at the distance of seven inches, row from row. There will be sufficient intervals between them, which when the turnips are all taken up, will be ready for plowing for the nourishment of the corn.

Cows are very fond of turnips, and they encrease their milk. Sheep also eat them greedily, and they are a wholesome nourishment: but sheep should have them while young, else they do not so well take to them.

Handhoeing of turnips, is but a poor method at best, and it is generally slighted over. The hoers, instead of breaking all the ground, tear up the surface of one half, and draw it over the other, covering the weeds with it, instead of

hoeing them up: so that, instead of being destroyed, they are only made to grow the stronger.

Drilling upon the level was the first practice with turnips, but it is a bad way. When they are drilled in ridges the hoe plow may come near the ridges, and go deep without mischief, but in the other way the young turnips are often buried by the earth falling over on the left side of the plow. Turnips planted on ridges, at six foot intervals, yield double the quantity with those planted on the level, with three foot intervals.

The best method of sowing by the drill, is to let half the seed fall into the bottom of the trench, which is to be four inches deep; and the other half over it, at about half an inch depth, lying upon the earth that has fallen in upon the other: and if half new and half old seed be mix'd, and the drilling performed in this manner, there will be no less than four different shootings: so that there will be four chances instead of one, for their escaping insects. It is lucky for the farmer, that as turnips are liable to this accident, the seed is so suited to the purpose of preventing it. Turnip seed will bear to be buried very deep, and come up well; and by this method, there will be new quantities rising for a fortnight together.

If all these chances fail, the young turnips may be hoe plowed when they are in the greatest danger, which will bury a great part of the insects; or another row may be drilled in, without doing any thing more to the land.

When the ground has been well prepared, the roller may be used with a great deal of success, upon a turnip field sown by the drill. We have mentioned the great advantage from it in destroying insects; and there is no kind that it more perfectly kills than these little flies.

The farmer often has recourse to his roller in the common way of husbandry, when he sees there is danger from the fly; but in destroying the insects he spoils his crop: for it makes the ground so hard, that the turnips cannot thrive in it. But in the drill way there is no danger. The ground may be rolled; for the hoe plow will sufficiently break it up, and loosen it again. The right method is to roll across the ridges, after it is drilled. The turnips may be after this thinn'd at a small expence, by hand hoes; and the hoe plow will then work wet or dry. If they have been stopp'd a little in their growth by the rolling, they will presently revive and recover after this practice.

C. H A P. LXIII.

Of the quantity of seed, and advantage of the crop.

THREE ounces of turnip seed, or between three or four, is the right quantity for an acre of ground; sometimes two ounces will do: and in the usual way, altho' we have mentioned two pound, many use three or four.

The farmer may leave the ridges, when the turnips are drill'd in single rows, with six foot intervals, higher than he can for double rowed crops; because there will be more earth in the intervals.

When the turnips are planted in six foot rows, wheat may be drilled between them; and in the same manner turnips may be drilled in between rows of barley and rows of oats. The poorer the land is, the wider should be the interval.

When wheat is sown between rows of turnips the method is this. At Michaelmas, when the turnips are full grown, a ridge is to be plowed up in the middle of every interval, and the wheat drilled on it: and then the turnips are to be taken up towards spring, and carried to the cattle.

In the thinning turnips regard must be had to their appearance, and those well growing ones which farmers call master turnips, may be left two together, if they happen to stand so, leaving the greater space on each side of them. But if three grow together the middle one should be pulled up.

The best instrument for breaking the earth left about the edges of the rows by the hoe plow, is the prong hoe; this has commonly two, sometimes three teeth, and that with three is best: but it must not be used till the turnips are of some growth.

When the intervals are hoed alternately, the plow may go deeper and nearer the row, because it is supported on the other side; but this is only to be done while the plants are small: at that time it is beneficial, but afterwards it would be dangerous. At the last hoeing it is a good method to leave a broad deep trench in the middle of each interval.

The crop of turnips has a vast advantage when raised this way, in that they better bear a dry season. The hand hoe does not go deep enough to do any service against this accident, which spoils many a promising crop: but the horse

hoe breaks the soil to such a depth, that it always keeps moist.

We have advised the farmer to use manures for his land intended for turnips; and even dung is allowed for this crop, by Mr. Tull its great enemy, because dung and tillage together, will divide and break the land in less time than tillage alone. This is a very necessary article in turnips, because they have so short a time to grow.

The same mistake may happen in judging of turnips in single ridges with large spaces, as about corn drilled the same way; they may suppose less stand upon an equal space of ground; but it is easy to confute the suspicion by counting. The best judges of turnips leave only thirty to a square perch when they have been sown in the common way, but when they are drilled with intervals of six foot, there may be five and forty left upon every perch of ground, and each will be much larger than in the common way. Sixty may be left in a perch, and they will thrive very well; and allowing these only at five pounds apiece, they will make a crop of above eighty quarters to an acre.

When turnips are drilled late, upon a poor ground, they will not be able to grow very large, and therefore the greater number is to be left. For the same advantages that would, in more time, make a smaller number grow big, will support a greater quantity of small ones, and their number will make amends for the want of size.

C H A P. LXIV.

Of raising wheat by the drill and horsehoeing husbandry,

WHEAT succeeds best in treble rows, with sufficient intervals between one set of rows and another. We have seen the advantage this method of tillage has, in respect of turnips, but its benefit with regard to wheat is greater.

The longer a plant is to remain in the earth the more nourishment it will require, and wheat is three times as long in the ground as spring corn.

The farmer knows it will want a great deal of nourishment, therefore he dungs his land to give it; and never sows wheat but on ground thus prepared, and well tilled beside. He thus gives a great fund of nourishment, but it is all laid in at once; it would certainly be better to afford

it this supply at times, as it continued growing. Such repeated assistance cannot be given it in the common method, but it may in the horsehoeing husbandry; and therefore this practice is particularly suited to that kind of corn.

The earth is prepared for wheat in autumn, in spring it wants most nourishment, for then it begins to shoot; but by that time the ground has got almost into its original condition again.

When the farmer is preparing his land for wheat in the horsehoeing method, let him take care to free it from grass. Other weeds may be got out when among the rows; but grass cannot; and it is so pernicious, that one bunch of it will spoil a yard of the crop.

The ridges for the drilling of wheat should be strait and equal; the plowmen knows how, by setting up a mark, to carry on the line quite strait: and to make these ridges even he needs only mark out several of them, before he begins. If the piece be of such a crooked form, that the ridges cannot be plowed strait the first time, it may be proper to drill it upon a level, and all the ridges for the next crop may easily be made equal.

Six foot ridges, being in number eleven on the breadth of an acre, they should be made lengthways of the field, unless there be some reason to the contrary: as if it be a hill any thing steep. In this case they must go up and down, whether that carry them lengthwise or breadthwise of the piece; for if the ridges should go across such a hill, they could not be well horsehoed.

As to the height of the ridges, the nature of the ground makes a difference, but as wheat always succeeds best when it is dry, a foot may be given for the general height. When they are narrow, and have a deep furrow on each side, the water that rains through upon them sufficiently moistens the ground, and runs off without poaching.

The deeper the soil is the higher the ridges may be made, and the wetter the land the higher they ought to be. In shallow soils the ridges cannot be made so high, because there would be a deficiency of mould in the intervals. But however high they are made, the tops must not be so narrow and sharp for drilling of wheat, as they are for turnips, because the wheat is to stand in a treble row; whereas the turnips do best in single: and a single row taking up less of the breadth, may have more of the ridges depth, because it leaves the in-

terval wider. As there is this difference in the sowing of wheat by the drill way, so there is to be a great deal in the reaping, for the stalks are to be cut off close to the ground. This could not be done in the common method, but it may in this, because all the plants rise in the rows together.

When this is done, and the crop is carried off, if the trench in the middle of each wide interval have been left as deep as it ought by the last hoeing, the farmer should take a common plow to the ground, and go as near the stubble as he can, and turn two large furrows into the middle of the intervals. This will make a ridge over the place where the trench was.

If the trench have not been left so deep as it should be, he is to go first in the middle of it with one furrow; which, with two more taken from the ridges, will be three furrows in each interval. This plowing is to be continued as long as dry weather lasts, and then the plowman is to finish, by turning the partitions on which the last wheat grew, up to the new ridges. This is usually done at two great furrows: and these last furrows, which compleat the ridges, may be plowed in wet weather.

Sometimes more furrows will be required to make a six foot ridge very high. Thus when the middles of the intervals are very wide and deep, there will require six furrows to the whole ridge, and they must not be small ones. The season also makes a difference, for when the fine mould is very dry, a great deal of it will run to the left hand before the plow; and more will run back again, after it is gone past.

When such ridges have been made for wheat, and the season continues too long dry for sowing it, and the stubble not thrown up, let the farmer plow one deep furrow on the middle of each ridge, and then plow the whole ridge at four furrows more. This will raise it very high. This practice stirs all the earth of the ridges, and is done at five furrows.

This is an important article in the drill husbandry, but the farmer may be guided in it with great safety by a few general rules. The furrows necessary for raising of ridges must be more or fewer in regard to the bigness. Six small furrows may be less than four large ones.

'Tis best not to plow the stubble up to the ridges till just before planting; especially in the early plowing, because
that

that will hinder the replowing of the first furrows, which, if the season continues dry, may be necessary. This may be done by opening one furrow in the middle, or by two, and afterwards the ridges are to be rais'd up again. When they are become moist enough at top, the old partitions being plowed up to them, they are to be harrowed once lengthwise, and then drilled.

The old partitions must be plowed up to the new ridges, to support their other earth from falling down with the harrowing and drilling, which would else make them level.

The ridges in this way excel common ridges of the same height, because, being made upon the open trenches, they consist of new tilled mould from top to bottom.

All other sorts of grain succeed best, sown when the ground is so dry, that it can be broke into moist parts by the plow, but wheat is an exception. Wheat is to stand the severity of a winter, and the ground must fall closer upon it, and it does so when somewhat wet at the time of the sowing.

In this method of husbandry, it is best to plow the ground when it is dry; and then let it lie till it become moist. But in speaking of this dryness and moisture of the ground, we are to be understood in moderation: the land need not be so dry as to fly like dust for the plowing; nor should it be as wet as pap for drilling; but in a moderate way on each side.

Wheat is a very particular grain. It is too tender to be sown in a dry time, as rye may be. It requires the earth to lie firmly about it in winter, to support its roots; and it requires it should be soft in spring for their passage. There is no way to give these advantages, like sowing it by the drill, in earth that has been well broken by the plow, and is become a little moist; and afterwards breaking the earth all about the rows in spring by horsehoeing.

After rain, when the ground is of a right degree of moisture for drilling of wheat, let it be harrowed with two light harrows drawn by a horse, going in a furrow betwixt two ridges. This will be sufficient in most cases, the furrow being just broken to level or smooth it for the drill.

If the ground whereon the next crop is to stand be plowed dry, the farmer may drill at any time during the season for sowing the kind of wheat he uses in the common method, but it is better to drill a little earlier than farmers sow than later. The season for sowing by the drill, may be said to last
from

from harvest to the beginning of November.

When wheat is drilled early less seed is required than when late, for less of it will die in the winter. The farmer is to consider the nature of his land, in proportioning the quantity. More plants will die in winter on poor than on rich ground, he must therefore allow more seed to poor land, than he does to rich.

When the farmer has a rich piece of land, and drills it early, he is to use less seed than on any other occasion; every grain will come up, and very few of the plants will die; and a few plants thriving well will send out a multitude of stalks, and bear an abundance of ears: so that the number of seeds is not the great consideration.

On rich land sown early by the drill, Four gallons of middle sized seed wheat is sufficient for an acre. In general, six gallons is the best quantity. A great deal depends upon suiting the quantity to the land and season, for if the corn be drilled too thick, it will be in danger of falling, and if too thin it will be subject to blights. A little too much, or too little of the seed is not so very mischievous, but this happens when it is much wrong either way.

As to the depth; it may be done from half an inch to three inches; but when it is too deep, it is in danger of being eaten off by worms in winter. This it escapes if shallow, because they do not lie near the surface in the severe weather.

Just when the wheat begins to appear above the ground, let the farmer beware of rooks. They perceive it shooting before he sees it, and that is the time they attack it. Let him keep them off the field for about ten days at this period, and all will be safe, the corn will then be exhausted of its flour, and they will not seek it.

The later wheat is drilled the more it is in danger of rooks, for if it be done soon after harvest, while there lies a good deal of loose corn about the ground, they will not trouble themselves to seek that which is buried.

C H A P. LXV.

Of the number of rows for wheat.

WE now come to a very material consideration; which is, the number of rows that are to be allowed to the intervals for wheat.

The drill may be made to sow in single, double, treble,
or

or in more numerous rows. In turnips the single row is preferable; but in wheat, that point is not so well determined.

Some have sown wheat in a single row, and left the full interval for horsehoeing between; others have drilled it in multitudes of rows, with few or no intervals of any space; but these are the extremes, and are equally wrong. In the make of the drill plow for wheat we have contrived for the sowing it in three rows, which is a very good method; but some prefer only two rows.

One of these two methods the farmer is to prefer, whether it shall be that by the double, or by the treble row, he must determine from the nature of his ground. If he drill in treble rows, the partitions must be seven inches; if in double, they should be ten.

Where there is only a double row, the weeds are easier destroyed between; but in the treble rows there arise fewer. In treble rows weeds are not so easily rooted up, without damaging the corn; in the double rows there is less hazard; if the ground be very liable to weeds, it will be best to sow in double rows; if it be naturally pretty free from them, it will be best in treble. This we mean by advising him to conduct himself according to the circumstances of his farm.

In favour of the double row way, it is farther to be observed, that the hand hoe cannot work near so efficaciously in two seven inch partitions as in one of ten inches: and the quantity of earth to be wrought by the horse hoe, is more when there is only a double, than when there is a treble row.

A less depth of mould on the ridge will do for the double than for the treble row.

Six foot ridges are necessary to the treble rows, but not to double, because the partitions between the two can be very well clear'd, and wrought by the hand hoe; and the earth of the intervals is wrought with much more ease and convenience: and in deep and rich land these intervals between double rows may be much narrower than they can be made with prudence in poor. The widest intervals of all are required for treble rows of wheat in poor land; in other respects the richer and deeper the soil, the less will do between the rows.

The management of the hoe plow is a great article; and the farmer must take care he employs an expert servant. The intervals should never be too wide to be horsehoed at two furrows, without leaving any part unplowed in
the

the middle of them; and the farmer will find, that by making the plank of this plow short, and the shafts crooked, so far as each will bear, he will be able to hoe with it in narrower intervals than he may imagine, without damaging the wheat.

When the double row is used, there may be fourteen ridges in an acre; there will then be only one partition on each that is between the two rows; and its breadth is ten inches.

This method brings the new husbandry nearer to the old; and as we shall advise the farmer, to come as near as he can toward uniting them, we shall direct him to harrow the land, after drilling, with the common harrow; it will cover any of the seeds that may chance to have been left bare by the drill harrow.

Hand hoeing between these double rows is easy; but let the farmer see that it is done properly, and not slighted over: the earth must never be turned toward the wheat; for it may crush it while young and tender, and the partition would never be hoed clean.

The hoes for this use should have the edge seven inches long, and be four inches deep from the handle; they must be thin, and well steel'd; and this work, at a moderate price of labour, may be done at about eighteen pence an acre, the working people finding their own tools.

For the wheat that is drilled in three rows, four inch hoes are more convenient.

In low ridges, when there are three rows, the middle one is poor; in high ridges it is as good as the others; but the question remains, whether it is not rich at their expence; perhaps as much is lost in them as is gained in that. Mr. Tull became of this opinion, and changed at last his method from the treble row to the double. Whether or not he was in the right we would have the farmer find by trials on different kinds of land.

Pease may be drilled by the same drill as the wheat, when it is made for the double row, only the spindle should be changed for one that has the notches a little bigger. This method for pease is preferable to any other, because the earth may be thrown so far upon the pease in the second horsehoeing, that the two rows will become one, which is very convenient. If barley be drilled, the three row method is preferable; but this is not proper to be followed by a crop of wheat, without a fallow. There is the same objection
against

against oats; because some of their scattered seeds will live out the winter, rise among the wheat, and hurt the sale.

C H A P. LXVI.

Of the manner of horsehoeing of wheat.

THE first horsehoeing for wheat is to be performed by turning a furrow from the row; and when the weather is wet when this is performed, the plow may go nearer the row, without mischief; when dryer, it must be carried somewhat more distant.

As to the time, it is best when the wheat has three or four blades: but it should never be done till it have more than one. If the crop have been drilled early, this must be done before, or in the beginning of winter, according to the condition of the blade; but when it has been drilled very late, it need not have the first hoeing till spring. Let the farmer have a strict eye upon those he employs, let him see they go as near the rows as they can, without damaging the corn; and as deep as they can, without going below the good soil.

If upon looking over the ground, he finds that the first furrow was not near enough the rows, nor deep enough, let him order a second to be plowed at the bottom of the former; and if this cannot be conveniently done soon after the first hoeing, let it be done before the ridge is turned back in the spring. Let the farmer remember always to have the furrows turned up, to make ridges in the middle of intervals, during winter.

Let him not be afraid of exposing his rows of corn to frosts, by hoeing off the earth from them in the beginning of winter; for it is found by experience, that when the hoe has gone nearest, the plants thrive best.

The row in this case stands, as it were, upon the brink of a perpendicular ditch, and the water therefore runs off from it; and we know dry earth is not affected by frosts like wet. The plants are thus preserved during winter; and in spring the ridge from the middle of the interval is thrown upon them, which is full of new nourishment, having lain all this time in the manner of a fallow, unexhausted.

As soon as the frosts are past, and the weather will allow it, let the intervals have their second turning: this is called the spring hoeing. The ridge from the middle of the interval

terval is then to be thrown to the rows on each side, by two furrows; as near as can be done without covering the wheat.

After this the farmer is to be guided by the nature of the land, and by the weather. He is never to let weeds grow to any height in the intervals; and never to let any unmoved earth lie in the middle of the intervals long enough to grow hard.

He will be thus guided in his work during summer; and these rules direct how many hoeings the intervals are to have. Only let him observe, that he must never plow deep near the rows in summer, when the plants are grown large; but, at the same time, let him take care to plow as deep in the middle of the intervals as the soil will allow; and let him turn the earth towards the wheat: especially at the last hoeing, so as to leave a deep and wide trench in the middle of each interval.

The stalks, instead of two or three, are thirty or forty from each grain; and whereas a great part in the common husbandry do not come to ear; and of those that do, a great many have ears very ill filled, with the advantage of horsehoeing, all the stalks come to ear, and every ear is full of good grain.

There is no way of producing a full grain like late horsehoeing. If this be done just when the wheat is gone out of blossom, the whole stock of nourishment is carried up to the grain, and the crop will be doubled.

By these means the horsehoeing husbandry produces a greater crop than the common, from a tenth part of the plants; for it encreases the number of stalks; it carries them all up into ear; it makes the ear large; and the grain plump, and full of flour. Four score ears have been counted upon one plant; and there have been numbered a hundred grains in one ear. If the wheat plant be capable of this vast increase and product, there is an ample field for the improvement that may be made by any method of husbandry, which shall better than the others promote its growth.

C H A P. LXVII.

Of the immediate benefit of the broad intervals.

FARMERS are averse to broad intervals, and the prejudice is very natural: it seems leaving so much of their

their land unoccupied. We have shewn this is a mistake; and it is here we may most abundantly prove it, arguing from experience.

A plant of wheat is capable of a vast encrease; and this is to be promoted by giving more nourishment. There are two ways of doing this, the one by making the earth richer, and the other by allowing more compass of it for the roots. The first is by adding dung and other manures; the other by leaving these broad intervals, and tilling them with the hoe plow. The latter method will succeed much better without the former, than the former can without that; but they will have their finest effect when used together.

To shew the advantage in its fairest light, we will at present consider the horseshoeing method; with its wide intervals alone, and without any addition.

We can, by allowing wide intervals between double or treble rows of wheat, produce a good crop with less labour and less seed than are needful in the common way, and without the expence of dung, or the loss of time in fallowing. These are plain advantages; and there is no difficulty in the practice.

If it be supposed the roots of wheat do not extend so far as half way of these broad intervals, we have shewn that it is asserted upon conjecture, and is most likely to be an error; and even if it were true, it would amount to no objection of weight: for this breadth is absolutely necessary for the working of the proper instruments; and at the last hoeing the earth is thrown on each side toward the rows, and a vacant space left in the middle of the interval, so that they certainly then have the benefit of it all, and that is the time when they most want it. There is then no part of the earth of the interval distant above seventeen inches in the double rows from the plants, or above two foot from the middle rows, when there are three. Thus far the roots of corn may be proved to reach, and the earth in giving them new tilled, and full of nourishment for the feeding the ear.

In deep land the intervals may be narrower than in shallower; but still they must be wide enough for the instruments to work: and if in shallow lands they should be narrow, there would not only want room, but of earth to work upon.

Horseshoeing will supply the place of fallowing and of dung; but there must be earth for it to work upon: there must be a sufficient breadth of interval, and a sufficient depth:

depth: if the intervals be so narrow that nearly all the earth of them goes to make the tops of the ridges, there will not be enough to support the plants, let it be ever so much improved by tillage. There must be quantity of land as well as quality, and as land is cheaper than manure, why should not the farmer allow it.

Weeds are apt to grow in the intervals that are hoed, but they are soon destroyed. They grow readily because the earth is improved by tillage; but as they are destroyed before they come to seed, by the repeated plowing, the damage is nothing. The ground is not stocked with fresh supplies of them, and they even had the benefit of a manure by rotting in the ground.

We see the drill and horsehoeing husbandry produce larger crops in the same piece of ground, than the common, and at less expence; and this advantage arises from the breaking and dividing of the ground in the intervals with the hoe plow. They cannot supply the rows sufficiently, if there be not substance or quantity of earth to work upon. The advantage is certain, and the necessity of breadth in the intervals is so plain, that at the same time we express our wishes that every farmer would give the practice a trial, we hope none will attempt it without giving the due compass, because that would not be fair; and the importance is enough to bespeak candour in the experiment.

C H A P. LXVIII.

Of raising saintfoin by the drill and horsehoeing husbandry.

WE shall hereafter consider the nature and qualities of saintfoin: we have here given the culture of it by the drill and horsehoeing husbandry, as an instance of the benefit of that practice.

The great advantage of saintfoin is the length of its roots. This pierces to a vast depth in the earth, and will support a large growth of it, where the natural grass would be little.

The driest and poorest ground may, by a proper management, be made to produce good saintfoin, but the finest and best will always be had from the best soil.

When the farmer is about to raise saintfoin, let him prepare his land well, and lay in the seed carefully, otherwise little will grow.

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The depth at which the seed is drilled, is a material consideration. In moderate land it should be covered half an inch, and in such as is very dry and light a little deeper, but nothing is so dangerous as the burying it too low in the ground. If it should be left naked upon the ground, it would not shoot at all, or perish when it had just shot.

The quantity of seed to be sowed by the drill, is about a bushel to an acre. This allows twenty seeds, or thereabout, to each square foot of the ground.

Let the farmer be careful in the buying his seed. It is often bad, and then his ground will be understocked with plants.

The season for drilling saintfoin is early in the spring. It is a common practice to sow it in the beginning of winter, but that is very bad; and to sow it in the heat and drought of summer is worse.

Lastly, in order to have a good growth sow it alone. It is a common practice to sow it with barley or oats, and this is wrong: some sow it with clover or rye-grass, and that is worse; it never succeeds perfectly, unless when it is let into the ground without mixture.

The farmer who is used to sowing saintfoin in the common way, will be surprised at what is here said, with respect to the quantity of the seed. Six or seven bushels to an acre is the common allowance; but in the single bushel in this method, we compute for a great deal of bad, for a much smaller quantity of plants than would be thus rais'd from good seed will be sufficient. No crop so well bears to rise thin as saintfoin, for it grows larger and sends out more branches in proportion as it stands more single.

When saintfoin stands the most single, in moderation, it will yield the largest crop. It spreads its roots to a great depth and distance, and a few well nourished plants are more than a great many that are but half fed. The common length of the stalks is two foot or a little more; but when it stands far asunder they will grow to six foot.

The root is found to encrease in length and thickness, in proportion as it is farther from other plants; and as the root encreases the stalks keep encreasing. The greater the number of plants there are upon a piece of ground, the smaller they are; and their number never makes amends for this deficiency in their growth. When there are but a few plants, they will support themselves without assistance, and encrease every year in strength and produce; while on

the other hand, the great number that are sometime raised by unskilful people, while they produce less, require manure or they will perish.

From the nicety required in laying in the seed of saintfoin, it is easy to see the drill husbandry is better suited to it than the common; but here is another reason: if the plants stand too thick they are starved, and yield little; but in this new method they are in less danger of this, because they are sure of having room on both sides, though they stand close in the rows; if the intervals be allowed a due breadth: and there is no crop which requires to have them larger.

When this plant is kept at a due distance, the second crop rises immediately after cutting: but when they stand thick it does not shoot till there comes rain. A moderate distance is leaving about a hundred plants on a square perch, and these will very well yield two ton to an acre.

If the farmer drill his saintfoin seed early in spring, and hoe it well afterwards, he will if the season be favourable, have a crop the first summer; this he is not to expect in the common method: the roots having time to strengthen themselves in the earth, by this early taking off the head, will thrive the better for the succeeding years.

On many lands, in the common way, saintfoin yields but one mowing crop in a year; but with right management it will yield two very large ones.

No plant has more advantage from hoeing than this. A quantity of hoed saintfoin will grow more in a fortnight, than such as is unhoed on the same land in six weeks; and that which is hoed will be fresh, green, and strong, while the other is poor and yellow.

C H A P. LXIX.

Of the manner of planting saintfoin.

THE best method is to drill it in double rows, with eight inch partitions, and with intervals of two foot and an half: these intervals are afterwards to be hoed only alternately, leaving the other to make the hay upon. The benefit of horsehoeing is evident in this plant, for it makes it thrive excessively on very poor land; and will cause it to yield two good crops, where it would otherwise have afforded but one, and that indifferent.

Less horsehoeing is required for saintfoin, than for any other

other plant, in very good land it may be omitted for two or three years, but when the ground is poorer it must be repeated oftener; and whenever the crop is seen to fade, this will refresh it. While the plants are small, care must be taken not to cover them with the plow, but afterwards there is no danger.

We have said the land must be well prepared for this plant: and care is to be taken in the whole raising it. The ground must be made clear of all other growths, and well broke; and care must be taken that the tines of the drill harrow exactly follow the shares, for the covering the seed.

No other harrow is to come on after saintfoin is sowed: nor is it to be rolled. But those who sow it with barley must roll the ground for the sake of that corn. No cattle must come near when it is young, and in the first winter give it a little manure of foot or ashes.

The expence of drilling is hardly a twentieth part of that in sowing it the other way, and the profit of the crop is generally double.

Less horsehoeing is necessary to saintfoin than any other crop; this plant will succeed extremely well by the drilling, without horsehoeing. It may be sown for handhoeing, or for standing without any hoeing at all; but the drilling is vastly preferable to the method of scattering in the seeds.

When drill'd for handhoeing, let the rows be made sixteen inches asunder; and the plants singled out by the hoer to about eight inches distance; but let the hoers take care to leave the stoutest and best growing plants.

When it is not intended to be hoed, the best method is to plant single rows, at eight inches distance, with no greater quantity of seed than when they are planted at sixteen inches. Either way there will be a profitable crop; but the horsehoeing and the drill together produce the richest, and the most lasting encrease.

C H A P. LXX.

Of the great advantages of the drill and horsehoeing husbandry.

WE have in a plain and impartial manner laid down the principles of the new method of husbandry; the manner in which it is to be performed; and its effects on three different kinds of crops. The farmer must by this time understand its nature, and it may be proper to close the

account with a short recital of its advantages.

The farmer, when he counts his proposed gain, should consider four things; the expence of his crop, the value of it, the certainty or hazard, and the condition of the land after it.

If the profit of a crop were to be computed singly from its price at market, that of the drill and horsehoeing husbandry would have the preference over that raised by the common method: but the expence also is greatly less.

The farmer may get more by a small crop that costs little, than by a larger that he has been at a great charge to raise; but in this consideration he has both the advantages.

Seed, tillage, drilling, weeding, and reaping, with the lesser articles in this method, do not amount to above the eighth part of the expence in the common way: therefore, were the crop much less, the profit would still be greatly above that of the other.

When the farmer shall consider the goodness of a crop, consisting in the quality, as well as quantity of the grain, he will see this advantage in a farther light; for he will find that wheat may be raised continually upon the same land, and that the grain will this way exceed, in every respect, that produced by the other husbandry. Not only land will continue to bear wheat every year, but it will grow on land that would not otherwise have yielded it at all, without an expence of manure more than equal to the profit by the crop. In this way of managing land it will yield good crops, from year to year, with no manure at all; and if a small expence be added for manure, the success will be surprising.

The certainty of a crop by this new method is much greater than in the old. In the common way he often suffers by the ear being too small, by the want of quantity, and often from its being too large, by the falling. But in the new husbandry the ears are never too small, and they are much less liable to lodge, because the stalks are stronger.

If we lastly examine the difference between the old method, and this, in the condition of the land after the crop, there is no comparison, for in the one it is exhausted, and in the other in full strength. A field that, after the expence of dunging, has borne a crop of wheat, is not fit to bear another, but the crop must be changed; and when it has borne two more of an inferior nature, all the work must begin again. But by horsehoeing, when it has borne

one

one crop of wheat, it is fit for another ; and the two furrows upon which the next crop is to stand, may be plowed as soon as the corn is off. The farmer who follows this method, can plow dry and drill wet, without inconvenience ; he can sow early, because he can, in spring, help the staleness of the ground by hoeing.

The success of horsehoeing is so evident in the giving nourishment to crops, that some have objected to it, as making growth too rank. There could not be a fairer confession of the excellence of the practice : for that which is capable of giving too much nourishment, may be so managed as to give just enough. When corn is too rank it is liable to accidents ; but it is in the power of the farmer to give it strength enough, without giving too much.

They say if this can enrich poor land, to make it bear great crops of wheat, it will make rich land too rank. The less of it may be used : and we have provided against such objections already, by advising the intervals to be smaller in rich, than in poor ground.

As some have been too violent against it, others have been extravagant in its praise. Enough may be said, without enlarging beyond truth.

We have proposed the true state of the case between the old and the new method, and we have written with impartiality. We have stated the advantages to spirit up farmers to make a tryal ; this advantage with which it has been used in France makes us earnestly desire here.

If we were asked whether most advantage may be had from the common methods, or from horsehoeing without manure, we should answer from the horsehoeing method ; but the greatest benefit will be obtained by employing both together.

The improvement of estates appears so plain an advantage to the nation, as well as a private benefit, that it would be superfluous to enlarge on it.

Whoever encreases the yearly value of his estate, encreases his own, and the yearly riches of his country. A great author says, " He that makes two chives of grass grow where but one did before, does his country more real good than all the generation of politicians together."

To the profit we cannot but add, two other important articles, viz. health and pleasure ; both which are the natural consequence of such undertakings.

Some exercise is necessary to preserve health ; and some relaxation

relaxation and amusement, are equally beneficial to preserve and improve the faculties of the mind.

All these good ends may be easily obtained, by viewing those improvements, which, if discreetly managed, would be far from expensive; be a blessing to the neighbourhood, procuring lasting wealth to a man's own family, and perpetual encrease of riches to our country.

This seems more particularly to require the regard of those gentlemen, who, being debar'd by our laws from encreasing their estates in land, may be induced to improve the value of those they are well intitled to; especially as one pound gained this way, is generally worth near two of old rents, as it is scarce over loaded with additional taxes or assessment.

And how pleasing a prospect must it be, to see an estate well laid out, and in good order, well fenced, and tenanted, and the yearly value thereof greatly encreased, as well as the good of the tenants promoted, with much less expence than a pack of dogs, a showy house, or a pompous piece of water, would occasion.

I shall only mention one delight more, the most natural of all others, a perpetual companion of the husbandman; and that is, the satisfaction of looking about him, and seeing the effects of his art and diligence; to be always gathering of some fruits of it, and at the same time to behold others ripening, and others budding; to see his fields and gardens covered with the beauteous creatures of his own industry; and to see, like God, that all his works are good.

I cannot be so sanguine as to think, that if persons of tolerable circumstances served apprenticeships to this art, "We should see, as is said, many aldermens estates made in the country," yet I verily believe, that if our gentry would turn their thoughts to subjects of this nature, instead of other pursuits, it would save many a fine estate, and preserve many an ancient family from ruin; and as to the plain gain of it, I have known some instances where persons in very private stations have gained several hundreds a year, by taking long leases of uncultivated lands, fencing and liming them well, and then letting them out again; whilst others have paid the purchase money of good estates, by the improved produce of the lands; and I have known an estate sold at five and twenty years purchase, parcell'd out in farms at five and thirty, and some of these sold again at five and fifty, and they then brought in near five pounds per cent. and the tenants did as well

well as at first. Such an improvement was made by only taking field land into closes by good walls, and then improving them by lime, or by lime and dung in proper compositions.

As to the usefulness of this to the mind, as well as to health, I may venture to affirm, that I shall herein meet with the concurring opinions of physicians, as well as the general practice of the most considerable persons of all stations, who take all opportunities of getting into the country when their affairs will permit.

Whoever considers that our souls and bodies are closely united, and wonderfully effect each other, will evidently find the necessity from our nature, to have some relaxation, to preserve that health, and those faculties.

The innocency of this life, is the next thing for which I commend it; and if husbandmen preserve not that they are much to blame, for no men are so free from temptations.

I would not here be thought to engage gentlemen in husbandry, as a constant occupation, or to expect they should hold the plow, or fill the cart.

But can they, whose health or affairs require their residence in the country, employ their spare hours in more useful, more innocent, or more delightful employments.

The mind of man must be employed, or will grow out of order, and these methods may be of much greater service to the young and unexperienced, than some in years are willing to allow. Probably they may serve to open their minds, and give them such a train of thinking, which may lay a foundation for a method of application to business, what will end in a solid judgment; and if pursued with discretion directly, or in its consequences, may dispel the tediousness of many a melancholy hour, remove the anguish of many a sorrowing heart, procure the ease of many family; and lay the foundation of establishing a steadiness of virtue in many an innocent unguarded heart.

If health, pleasure and profit, are the consequence of these undertakings, it may not be improper to enquire, how they come to be so little pursued; what lion there is in the way to obstruct or terrify us.

Three things may probably be objected.

That this is beneath the dignity of a gentleman.

That several who have busied themselves in buildings, alterations, and pretended improvements, have felt bad effects from such undertakings. And

That gentlemen are unacquainted with these things; and consequently liable to be frequently impos'd on in the management; and deceiv'd in the expected success of such projects.

To the first it may be answered, that we do not propose gentlemen should condescend to the meaner labours of the husbandman; but sure a prudent ordering of his own affairs, can never be below the dignity of a wise man; and if examples of the greatest in most ages, might prevail against the weak modes and practice of the moderns; that method of life can never be contemned, on which Tully, Virgil, and Horace, have bestowed such encomiums; from which dictators have been called to the command of armies, and to the pleasures of which mighty emperors have retired from the fatigues of grandeur.

In this corner that great man (Scipio) says Seneca "the terror of Carthage, and to whom Rome owes that it was but once taken, after manuring his fields with his own hands, would wash himself," for he chose to work, and tilled his ground himself, according to the custom of our fathers.

As to the ill consequences of applications of this kind; I believe if those instances were particularly enquired into, the ill would be found to arise from ill-designed, ill-executed, or extravagant houses, out-houses, dog kennels, or monstrous gardens.

As to the last objection, that gentlemen are unacquainted with affairs of this nature, and liable to be imposed on; the truth is not to be denied, but the principal intent of this undertaking, is to provide a remedy for this inconvenience, by laying down rules to guard the unwary, and to guide the unexperienced.

Improvements of estates may be consider'd in three views, as they arise from what I shall call natural advantages; convenient buildings, laying lands commodiously together, dividing them into proper parts, fencing them well, with things of the like nature.

Secondly, by what may be called artificial improvements from manures, as by lime, salt, or burnbaiting; and by the different sorts of foreign grasses, as clover, saintfoin, and the like.

Lastly, as they arise from the common or late improved methods of husbandry, as dunging, plowing, and well managing all sorts of ground.

We shall at present consider the first. Things of immediate

diate use being of a greater consequence than the most curious speculations.

This rule is applicable to every farmer and labourer, and indeed to men in every station of life.

As examples make deeper impresson than precepts, I shall mention a case of my own, in a particular of this nature.

When I purchased the estate where I have since lived; I found a well, with its usual conveniences, about sixty yards from the kitchen door, and when I had fixed a pump there, I still found the expence of carrying water, taking in brewing, washing, and other accidentals, half a crown a week: on this I laid the water into the house from a cistern, placed under the pump; by which means the house was easily supplied.

The expence was about eight pounds, and for this one pipe was laid into the kitchen, one to the wash-stove in the brewhouse, one to the side of the copper, and another into the garden.

Every farmer will find the difference of milking near home, and at a distance; and in one place only, or in different pastures.

A good oeconomist will contrive his affairs, as far as he can, with prudence, so that what is most wanted shall be the nearest, and those at the greatest distance which he, or his family, have less occasion to resort to.

The substance of natural improvements, may be comprised under the following heads:

- Commodious buildings;
- Laying farms and lands conveniently together;
- Dividing large grounds into lesser:
- Keeping up good fences and places for shelter;
- Supplying grounds with water to float them, and making proper watering places;
- Draining grounds which are too wet;
- Proportioning corn land and grass ground properly for the farm;

Making good roads;

Lastly, I shall mention the alteration time makes in the value of most lands.

1. Of commodious buildings;

Here I shall only observe, large timber is one of the greatest expences of building, and great roofs require the greatest expence to support them: in farming affairs a narrow and long building will answer the end as well, or better than a short
and

and wide one; except that where they throw their corn to clean it, which requires space, the expediency of which method will be hereafter considered.

In other cases, having room to thrash in the barn, and a door towards the south west, the farmer will seldom want a wind to clean his corn; and when such a case happens, a hand fan will supply the want of it.

As to standing for beasts, thirteen feet wide will do for four, whereas six requires twenty foot wide, and every person of experience well knows, that building a roof of above twenty foot wide, and the expence of keeping it in order, will far exceed that of thirteen feet wide with the addition of seven or eight feet more in length for a third row of beasts.

As to the great barns formerly erected, they are little valued now; several judicious farmers refusing to use them; apprehending their corn and hay to be better and sweeter, when set in stacks in the open air, than when housed. And in many places the tying up their beasts, at any time of the year for the whole night, is omitted.

What is of greater concern, is the benefit which arises to the owner of a farm, as to the ease in the management of it, and the preserving it in a proper state of husbandry, when the buildings are prudently placed, in comparison of those erected at a distance, or in low places from which the manure can scarce be returned to the land again, except at a great expence; and consequently the distant land must be gradually impoverished.

When the buildings are on the level with the land, and in the midst of it, the manure cannot be lost, and the whole course of husbandry will be carried on with more ease, and at less expence.

The advantage of this I saw very plain, in removing an old house which stood in a village distant from the land, into a proper place in the midst of the farm; by which means they always milked at the door; and one man, woman, horse, and sledge, managed the same in general with as much ease, as two men, two women, a cart and horses did before. Any one may compute how much was saved by this in the year.

Lee walls (as they are call'd) are frequently erected in the shape of a great L, on commons, and in large pastures, by common tenants, to shelter cattle against storms, from every point of the compass. The benefit of them is well known;

known; and I have wondered something of this kind is not more frequently to be met with near London, and several of the marshes in Kent and Essex.

A small useful building for this end, might be contrived at little expence; and constructed so as to be taken in pieces, and carried from one place to another.

In a bleak marsh in Essex this summer, with two men in one day I made a shelter on a rising ground for the workmen, and so on, by sinking the ground above a foot, and making the side walls and back part with turf and soil, and then covering it with boards, which answered every end, and will do so till the work is compleat, and the wood carried away.

When the late Czar built Petersburg, he contrived the houses so, that any one might on occasion be taken down in two hours, and set up again in another place.

A roof alone might be order'd so as frequently to be useful to set over a quantity of new hay in summer, till a large rick be made, or even to cover the rick till it was finished in the nature of a moveable Dutch barn; by which method a great deal of damage and trouble, by intervening rains, might be avoided. Few farmers but suffer yearly by rains, before their hay ricks and corn stacks are well covered.

Some use old tarpawlins: these may be of service, and so would two or three fleaks thatched, and hung cross a rick, which any farmer may easily procure, or make for himself.

Slight moveable buildings might be of equal use to our horses and cattle in summer, by affording them shelter against violent heats, as they do in winter against storms, frosts, and cold.

Our bodies, and those of our beasts, are much alike: we are subject to the same diseases, and alike sensible of heat and cold, piercing winds, and violent storms.

In Jamaica there are times, when, unless the labourers put on their cloaths, they will be in danger of losing their lives; and in most places with us, piercing blasts have been almost as prejudicial, and some winds subject us to particular distempers.

Every housewife is sensible of the ill effects arising from cows being hurried about in hot weather, both as to the goodness and quantity of their milk. And I know a farm in Cheshire, which on a moderate computation, is thought to be damaged five pounds a year by the cows being deprived

prived from standing in a river in the heat of the day; and the prejudice to the pastures, by their gadding and running about, is very well known.

The next head we have to consider is,

The laying farms and lands conveniently.

Two acres together, of the same conditioned land, is of as much value as five half acres in distant places in the same open fields; the advantage is proportionably greater when the portions of land are less; and it is not uncommon to find many parcels of land both in open fields, and good meadows, containing much less; which when laid together, and inclosed, are often more than double or treble the value they were before, especially near great towns, or in countries where grass ground is scarce. Within my memory, there have been fifteen hundred acres of field land inclosed near Derby, which from eight or nine shillings an acre, whilst in the open field, is now let from three pounds to twenty shillings, and on an average at about thirty.

This leads to the dividing one part of large grounds from another in proper quantities.

This depends on the same reasoning as the last articles; and to the instances before given of the benefit of it, I shall here add another of a formerly remarkable piece of land, called Haddon pasture, near Haddon in Derbyshire, the ancient seat, and place of residence, of the Duke of Rutland's ancestors. This was a large piece of lime-stone ground, and was usually joisted by taking in beasts from all the country over.

It has been lately divided into several parts, with lime-stone walls, and let out again to under tenants for two hundred pounds per annum more than the original rent.

I could give other instances wherein I have been concerned, of the same proportionable profit arising solely by the parting large grounds with lime-stone walls in counties where that material is to be had; which, though not so sightly, may perhaps be found the most beneficial fences in the kingdom.

Where lime-stone is to be had near, the stone will be got, led, and walled seven quarters high, for about four pence per yard forward. The foundation is but two foot broad, there are no ditches on either side, or any loss of ground; for the scythe may cut, or the plow; and the cattle have shelter and food, close to its side.

Here are no roots to run and rob the corn, no branches to

to drop on it, these walls nourish the land seven or eight yards near them. Many are warm against any plowing nearer hedges than seven or eight yards; and a very judicious farmer told me, that he never expects or finds above half a crop near hedges, in proportion to what he reaps in the middle of the field.

This ought to be minded, in those places where the culture of corn is designed; near St. Alban's, and toward Hempstead, the corn fields are generally large, twenty acres or more each.

Where new hedges are to be raised, white thorn is generally best; and if planted in proper ground, may be made to save itself in four or five years, and a dead hedge, once repaired, will guard it till it is safe.

I once planted a hedge of this kind with strong sets out of the woods, of above an inch diameter, set them eight inches asunder, and cut them within eight or nine inches of the ground; some of them shot that year six foot high, and all soon made an hedge for cloths, when cut and kept in order, four foot deep, and a yard over.

I had much the same success with some thorn bushes I removed, cutting the heads, they soon answer'd. I have let some white thorns grow as large as trees; and there are some single ones on the Derbyshire moors near Middleton, by Youlgreave, which are as large as middling ash.

This method of raising white thorn is not practised. But I cannot but think from the nature of the shrub, that a design of a gentleman of my acquaintance, was both reasonable and feasible.

He set in two acres of ground several rows of white thorns, which one out fence secured. These, when grown up, supplied him with a successive stock of sets; and when he had occasion to take in any new piece, he took part of this to about a yard high, and set them as a new fence, the thorns fenced the outside, and the ground being corn, and nothing admitted into it after the corn, at the end of the second year it made a very good hedge.

Such a tryal can be no great hazard; the young sets may be bought at four pence per hundred, which, at nine inches distance, will go a great way; and if they are to be rais'd from the berry, there is a method taken from an experiment of Sir Isaac Newton's published by Mr. Bradley, of bringing them to sprout in the first spring, by placing them in wheat bran, kept warm, and sometimes wetted a little.

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This I tried, and they sprouted in spring, but if too much wet be given them, it will be in danger of rotting them.

I have a dislike to black thorns, on account of their spreading in the ground; white thorns are so hardy, as to thrive where few trees will, so it may be used as a good high hedge, or as a row of trees, to shelter against cold bleak winds. I have seen such a hedge grow amongst elms, which, cut properly, seemed to be one entire close fence, of forty foot high.

As to dividing of grass ground, many are of opinion, that one close of ten acres will maintain as many cattle as four of three acres each; the reasons they give are, that in lesser grounds cattle quickly walk over them, and being stained with their feet, they will not care to feed thereon; whereas, in larger fields they have room to range and feed, till the stained places be refreshed with rain or with the dews; that there is a loss of ground by hedges and ditches, that 'tis easier to get water in a great piece than a little one, and that cattle love a large walk, and like not grass under the dropping of trees.

To all this it may be answered, that the dividing ten acres into four parts, allowing two yards for the hedge and ditch, these take up but about one sixth part of an acre; that if there be water it may be easily laid to two or three of the lesser closes, or that may be eaten first which has the water, and then laid to, that the other hedges and trees may be kept down, so as not to sour the grass much; or if permitted to grow they will be of above an equivalent for that damage. And when the closes are eaten by turns, the first will be wonderfully recovered and sweetened, before the cattle are brought back to it; and it is not to be imagined what conveniences arise from four or five such small closes. At the best managed farm I know, they have six of them, they can go into or from the fold yard, in which they can keep their swine and clover, and let them out each night to their supper; keep a cow or two on good grass, for milk and butter, a horse or two, to be ready on every occasion, and eat the others as proper, whether they be turnips, clover, or grass; or lead through them to farther distant larger closes, or keep a piece of choice grass, clover, or turnips, to top up fat beasts with, or support them with when other pastures fail.

Fences are a security to our property, and the great preservers of piece and quiet in a neighbourhood. They preserve our grounds and our cattle warm and well, and have such

such visible good arising from them, that it becomes a sort of a proverbial saying, amongst the farmers, that "A warm, close, high hedge, is half the cattle's meat in winter, causing that which is given them to do them the more good.

Our next article is, the supplying grounds with water to float them, where that can be conveniently done, and making proper watering places where wanted and suitable.

Where lands are situated near rivers, the benefit of floating meadows in dry seasons is easily obtained; for water may be easily guided from place to place, and near several great towns there are meadows which must be mowed and cleared by Midsummer, lying common after, which owe their returning fertility to the wash of the floods overflowing them after the hay is got in; for which purpose those banks which are raised to secure the grass from floods, are immediately after opened in several places, to enrich the same meadows by all the succeeding waters, till the following spring, when the banks are again made up.

This is so fine a way of improving, that wherever water comes from off rich lands, or is impregnated with the wash of any town, such a floating is much to be desired; and it is a very good practice to mix manure with common water, stirring it as it passes, as the water will, this way, convey it in the most beneficial manner to the grass roots. Where none of these are to be had in great droughts, the conveying common water over the meadows, will be very beneficial.

What is more immediately under our present consideration is, how to provide for that want of water, which is commonly the case in lime-stone, chalk, sandy, and gravelly grounds, which though they receive their equal share of rain and dew being porous, the wet soon sinks in, and is lost.

In some grounds of this nature there are pools of water, which supply the cattle. Where such are not met with, there are very few quantities of land where, in a low place, the rains may not be brought from the higher ground, and a watering place made, by laying in a proper mixture of clay, or by a bed of lime rubbish well beat together. Worked chalk will answer the same end, laid at the bottom, and sides of a pit, which if well made, will last long and answer the purpose, especially at the end of summer, and in winter. Care must be taken to cover the bottom with some sort of pavement, to prevent the cattle from poaching holes with their feet; and there must be some walls to keep the tem-
pered

pered mortar safe on the sides, as high as it is proposed the pool should stand ; and little cuts, if necessary, to bring the water from above, to the place prepared for it.

The first of this kind I saw, was in a gentleman's lime-stone park in Somersetshire. The owner told me it cost him at first thirty pounds, and soon failed ; but the breach being found and prepared, it had then stood firm many years, and was a very large one. Small ones are now made, where the materials are near, for forty or fifty shillings, and may be so contrived as to fit two or three distinct parcels of land, by parting them in the middle, or by loose moveable rails, to lay them to one side or the other.

The same gentleman had walled his park high enough to keep in his deer with lime-stone. He poured in two beds of mortar whilst it was building, one at about two foot high, the other about four, and the wall stood firm.

Excess of wet is as prejudicial as the want of it. This brings me to the manner of taking water off, or draining grounds which are too wet.

The first point is to find the lowest place by which the water can be carried off, and there open a wide trench, of depth sufficient to drain the whole, which may properly be kept open ; into this side or cross drains may be laid and covered.

The best method for these cross drains is that used in Essex, by making a trench near two foot deep, not above two or three inches wide at bottom, then filling it with thorns, or any rubbish wood, and covering it by turning the turf downward. The difficulty is to lay the drains in the lowest places, in which the Essex men are particularly skilled.

I have known, where stones were in plenty, little suffs made at bottom, and small stones poured on it a foot deep, so covered up, which answered very well. I have also known wet grounds much mended by very small gutters, of four or five inches wide, leading to proper descents, and what came from them spread on the ground, to prevent its being trod in again. These are easily made, and easily kept open, and if deeper than the roots of the grass, they will on clayey ground carry off the wet very well.

The proportioning of corn land and grass ground proper for the farm, is an article scarce possible to bring under any general rules. Since the new husbandry has prevailed, the farmer may keep more in tillage, or grass grounds of natural or artificial grasses, as he pleases ; and needs not want of
either

either to employ such a team as he thinks proper to keep, such cows as he chuses to milk, such cattle as he proposes to rear or seed; in most of which a judicious farmer, if he has ground enough, may make it answer any end he proposes, with proper application.

One general rule indeed he ought to adhere to; which is never to have more ground in tillage, or appropriated for hay, than he can husband and dress well.

He had better have two good acres of corn than six of bad, or four of middling: the expence attending the worst, is as great as that of the best.

The same in proportion may be said of hay ground; and in both cases, if the worse sort be pastured, or lie fallow, it will be of some benefit.

Of making good roads:

The making roads good meets with so general approbation, that there seems not to need any thing be said to influence gentlemen, to do it about their own houses, and also to promote it in their respective neighbourhoods.

This might be generally compassed by the usual labour of the villagers, and a little money expended under the direction of a person skilled in the work; by which method I have known hills, before hardly passable by a single horse, made as easy for a coach as a street; and the side of a precipice made a safe common road, without danger or terror to the traveller, by a wall erected next the precipice.

The safety to man, horses, and carriages, the cheap conveying all sorts of portables from place to place on good roads, and the time saved by it, will soon be an equivalent for the expence, and perhaps extend its usefulness to unexpected distances; so that it may be a blessing to a country, and to future generations.

The greatest improvement of this kind I ever knew, was betwixt Wych and Worcester. When I first travelled that road they were beginning to mend it, I saw eight or nine horses hard set to draw a tun of salt; but passing there again some years after, I saw no waggon had above four horses, and some but three, to draw the same quantity.

The Romans in this particular demand our applause and imitation; for they caused good roads to be made from place to place, wherever their legions came, and some of these works are still visible and useful amongst us.

The people of Cheshire and Lancashire have, I believe,

laid out more money in making good roads, and to better purpose, though materials are very dear in many places there, than those of any six counties in England, exclusive of turnpikes. Most farmers there have a horse pavement from their doors to the great roads; and some gentlemen have expended an hundred pounds, in paving from the road to their own doors, which in some places would, if wisely managed, repair the roads for some miles.

A good paviour will carry on a horse causey in a day, sixty yards. I had a servant of my own, who with a labourer to assist him, and teams to lead to him, in a lime-stone country, made a new road above eight foot wide, and ninety long, in one day, setting both out-fides with the largest stones for near two feet on each side, where the wheels run, and filling and raising up all the middle with what we call lime-stone gravel (being small lime-stone) which if not trod on, in a few days, will bind like a rock, and on which the horses will tread freely, which they never do where the roads are set with great stones.

The late ingenious Mr. Cooper, of Leicester, who gained so much reputation by mending their roads, brought all his work to the following certainties.

Twenty up-heap'd strikes (or bushels) were a load, which, when first measured and levelled as usual, laths were nailed on the carts for ascertaining it for the future.

Each farmer filled his own cart, and had generally one penny half farthing each hundred yards it was carried.

The gravel was got and spread at one penny per load, and a person was appointed to see all fairly done.

Water gravel never makes so fine a road as what is dug out of the earth, but where that is easier to be had, being mixed with a sandy soil to bind it, it will make a good road.

In some places we meet with a soft gravel, having too large a mixture of clay, marle or sand amongst it, which, though laid thicker on the road than ordinary, will not stand one year's wear. Yet we have found that some gravel, after screening it, as it is done for gardens, and leaving what falls through behind, to make as good and durable roads as any we have.

These particulars I have taken from a manuscript of that gentleman's never published.

The last article I have to mention here is;

The alteration time makes in the value of most lands.

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This difference cannot be said to be an improvement, but an alteration, arising chiefly from the additional quantity of gold and silver constantly brought into these parts of the world; so that, properly speaking, gold and silver are of less value than they were formerly, as an ounce of either will not purchase half of the quantity of the necessary provisions for life (exclusive of the taxes laid on several of them) which they formerly did.

The rents reserved in money, in college and other leases, and those paid in corn, which in Queen Elizabeth's time were of equal value, now are so different, that they are a full proof of the variation; for the half now paid in corn, malt, and so on, is at present above three times as much in value, as the other moiety still paid in money.

Lands then let at twenty shillings per annum, should now be of the value of near three pounds, unless in some extraordinary circumstance; as where the great improvements made by lime, and artificial grasses on high lands have sunk the yearly value of those low meadow grounds, which, being enriched by the over-flowing of the rivers from the lime-stone mountains, pastured with sheep, used to be the only places where spring grass, and early fat meat were to be had: it being also within memory, how better families were obliged to lay in great quantities of hung beef for winter, very little of that sort of meat being then killed in that season, even in great towns.

The reader has been led through all the various soils to be met with in these kingdoms, and the different methods commonly taken to improve them by dung, as well as by lime, salt, and the like: all these have been copiously treated of, and the method and manner of plowing, sowing, harrowing, and rolling, have been explained. The several corns, grasses, and roots themselves come now to be particularly considered.

But before we enter into the distinct consideration of these, it will be proper to take a short view of the antient and modern tillage; these being stated in a plain manner, the reader will be instructed to form a proper judgment of their advantages and disadvantages, and well know how to fix to himself a sure rule for his conduct.

Of the old husbandry.

The usual method of tillage in the corn counties in England, was conducted in the following manner.

Each village in the corn counties had three distinct common fields, usually of equal quantities; which were appropriated to three several yearly courses of tillage.

One of these three, each year, was appropriated chiefly to wheat, though sometimes it had barley in it, and this has always born the name of the wheat field.

The second is called the pease field, being sowed, for the most part, with that pulse, though beans and oats, as found convenient, are commonly sowed therein also.

The third field, or side, is called the fallow field, as not being sowed at all; but repeatedly plowed, harrowed, and manured, as the owner judges best for his land, to prepare it for the following crop.

These three names are successively applied to the said fields, according to their course, of being sowed with wheat or pease, or lying fallow.

These were the rounds of the English tillage; and they were sufficient to produce good corn, and that in great quantities: and the same method is still continu'd in those parts of the kingdom, where the new husbandry has not prevailed.

The manuring, and two year's due plowing, the two fallow years (with proper plowing and sowing the other four years) were found sufficient to produce four successive reasonable good crops in the six years; and those four crops produced a sufficient quantity of manure, for the dunging the ground during the said circle of six years.

But when lime was found beneficial for producing of good corn, and was applied accordingly for that purpose, where that could conveniently be had; it made the well manuring the common corn fields much better and easier, and rendering the less dung necessary for the said four crops in the six years.

And though corn was also formerly sometimes sowed in inclosed grounds, and much more so since the late improvements made by clover and turnips; yet the open fields always had, and still have the preference, as producing the best and sweetest corn, and as the least subject to smuts and blights; and it is also found, that corn growing near an hedge has not usually so great a quantity as that which grows in the middle: the reason for which will be mentioned hereafter. Open fields have also more sun and air, are less annoyed by birds, and have less fences to be taken care of, those being usually made by the lands adjoining to them.

There are some inconveniences open fields were always subject to, by their being generally divided into small parts,
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the property of different persons ; for by this the farmer is obliged to plow always the same way, observing also pretty much the same times and seasons of plowing, sowing, reaping, and fencing.

The dividing the common corn fields into so many small parcels, is worthy a distinct consideration. A farm of mine, under thirty pounds per annum, contains one hundred and fifty three pieces, forty of which are not each a rood, and two acres no where lying together, and the whole township is much in the same manner, very few of the larger estates having two acres together.

This method of dividing fields, is generally thought owing to a political design of our ancestors, to promote the culture of corn, by preventing the fields being inclosed, as they were made the distinct property of so many different persons.

But I presume it was rather owing to the parting it amongst the followers and soldiers of those who conquer'd, as a recompence for their services.

This seems the old method of the Saxons, as appears by the customary mineral laws in Derbyshire. By these, though the whole mineral field is at liberty for any person to work in, yet if any one finds a mine there, he can take but so many yards as the first proprietor ; and every other subject, and he himself may take other quantities of two and twenty yards, one after another, till the whole be possessed or taken ; but then, every distinct said number of yards so taken, is a distinct title and possession, and may be separately owned by different persons in partnership. This and many other customs, prove that the law used there is the best remain we now have of the Saxon method of proceeding, which was short and clear.

The method now mentioned was, in general, the course of the English tillage, till the introduction of the foreign grasses, gradually within about eighty years last past ; and the advantages by the sowing these and turnips, in inclosures, and now in many of the open fields, and particularly by that of clover.

By clover and turnips many of those lands which formerly were of little value, have been rendered profitable, and brought to produce good corn : and those lands in the open fields, and in the inclosures, which formerly were thought to answer well to the plow in the course of tillage, have been improv'd even in that respect, by the sowing of clover and turnips : and that third year, which was before lost by

lying fallow, is now generally made to produce a crop of clover or turnips worth, if well managed, at least twenty or thirty shillings an acre, often much more. These growths are so far from occasioning any additional expence, that they are found much the cheapest and best methods of preparing the land for corn.

These things have given a different turn to the general course of our husbandry; and where the sowing of clover and other grasses, and of turnips and other roots have prevailed, the method has obtained the name of the new husbandry; to these we may not improperly add the drill husbandry, which is not so modern as some pretend, being introduced here by the late Earl of Sandwich, as appears in the *Philosophical Transactions* *. The inventor of it was Don Joseph de Lucatello, who had it publicly tried in Germany and Spain, and had a patent granted him by the King of Spain, about the year one thousand six hundred and sixty five, as the inventor of the drill plow, called then the *Sembrador*, contrived to plow, sow, and harrow at once.

The same method of husbandry being practised by the late Mr. Tull, who wrote a book on this subject, has now prevailed in several places, and may be properly considered under this head, as a principal part of the new husbandry; to which we shall now proceed.

Of the new husbandry.

The advantages of this new method of husbandry, when set in a proper light, and compared with the former customary tillage, are so great, as justly to entitle it to the preference: and it very well deserves the attentive consideration of every person any way interested in affairs of this nature.

As we have stated the course of the former method of husbandry, we shall endeavour to do the same by this: but the modern method admitting many more variations, both as to the different sorts, and greater number of seeds to be sowed, and also more yearly changes of the corn, than the other, the course of this new husbandry cannot be comprised in so few rules as the other.

In this there cannot be many certain rules of successively sowing of grain; for there being many more seeds, and roots to have their turns, they give the farmer a much greater latitude of varying and altering his crops.

By this method it is proposed, that the farmer shall have

* *Philos. Trans.* 2d Vol. 741:744.

have six successive profitable crops, for six years together, from the same parcel of ground, without the loss of any one year, by letting it lie fallow: at least he may reasonably expect eleven good crops in twelve years; and all these eleven or twelve crops successively, year after year, to be of as valuable sorts of grain, and as good in their kinds, and got with as little trouble, and at as little an expence as the four crops obtained in six years, or as the eight in twelve years usually are in the open fields.

To manifest the truth of this, it will be necessary to state the course of this new husbandry in two or three different methods.

By one method wheat may be ordered to have its turn once in four years. Thus,

First, wheat. Second, beans, pease, or oats. Third, clover. Then wheat again.

Or beans, pease, or oats, may be varied, and the clover omitted, as the farmer pleases.

By another method, the wheat, barley, or other grain, will succeed one another but once in six or seven years; and may be ordered after the following manner.

Wheat the first year. The second, beans, pease, or oats. Third, any other of the last three. Fourth, turnips. Fifth, barley. Sixth clover, and then a return to wheat, or any other of the crops; for which the ground will be well prepared again: or if it be liked better, the clover may be continued two years, and will answer very well.

Reckoning the clover as proper to be sowed two years in the six, here is a provision for eight years crops, out of which the farmer may chuse any six of them he thinks the most suitable to his soil and circumstances.

By this method he reaps three of the richest crops, and one of beans or pease, one of turnips, and one or two of clover, in six years succeeding each other; whereas there can be but four obtained in the same time, by the common tillage. Consequently the new method has the advantage of two more crops in six years, than the old: which on presumption that the crops are equally good, is greatly to the advantage of modern husbandry.

These grains and seeds may be farther varied, the better to prevent the too quick a return of sowing the same corn again on the same ground, which is generally attended with a poor crop not only in all grain sowed in the field, but in every herb and root propagated in the garden. Therefore

the judicious farmer will frequently change the grain, herbs and roots, from one spot of ground to another; till time, or some course of husbandry, hath prepared the first ground again for producing another good crop of the same. Nothing but horsehoeing can set aside this necessity.

A very little consideration will guide the farmer in varying the above named grains, grasses, and roots, so as to be reasonably assured of obtaining good successive crops.

To the great variety of succeeding crops, which may be contrived from the several species of grain and grasses above mentioned, the farmer may add many other new changes, by the sowing of rye, French wheat, lentils, coleseed, and so on; with which he may make such various changes, as to carry on a course of profitable tillage of the same ground, to a much greater length of time, especially after it has had the benefit of being marled, limed, or chalked. Four bells will change or vary their places so as never to come again in the same order, four and twenty times, and five one hundred and twenty times: here are many more than five sorts of grains, grasses, and roots, which may be brought into the succession.

Wise farmers will not carry it to those great lengths: but will chuse to lay down a part of the ground they have in tillage, with profitable lasting artificial grasses or good natural ones; and break up some fresh ground for corn; and by these methods he may vary his crops as he pleases, and give his several grounds what years of rest he thinks proper, before he brings them on again to a new succession of corn, in a new round of tillage.

The passion for the plow is very great, and for wheat in particular, as it is the best, and most profitable grain; but other crops will often be found more beneficial than wheat in too quick a succession.

As to the profit of respiting the wheat crop only for one year, I will calculate the respective gain which may be expected from wheat crops in twenty years, when sowed each fourth year, and when sowed each fifth year during that period; in which the longer the intervening time is between, the better the crop will pay.

In the first method there will be five returning crops of wheat in the twenty years, and three years between each crop to improve the land; and it cannot be reasonably supposed to produce above twenty quarters, that is, four quarters each wheat year.

In

In the other method there will be but four crops of wheat in the twenty years, which, with the same method of husbandry, and one fourth more time, must be the better prepared by one fourth part for producing a better crop: this then must be five quarters each four wheat years; which will amount to just the same quantity of twenty quarters in the said twenty years.

This is not only agreeable to reason, but to what we experience in the course of husbandry; and the crops in general are better or worse, according to the time allowed betwixt the fresh sowing again of the same sort of grain.

Supposing the profits equal in the case of the four years of wheat in the twenty, there will be the seed and husbandry of one year saved; and as it is probable clover might be continu'd the year wheat was omitted, or a crop of turnips got; such a crop, and such a saving may moderately be estimated at two pounds ten shillings.

The substance of all the modern improvements, is principally owing to clover and turnips, each of them producing great quantities of sustenance for cattle, and preparing the land for corn.

Those therefore deserve to be treated in a more full manner.

And since wheat is the principal grain, and the most profitable, and clover and turnips are the best preparatives for it; we shall consider wheat, clover, and turnips as the three chief kinds; and do justice respectively to their useful qualities. We shall thus take in the principal part of all what concerns the old tillage, and all the material alterations and improvements made by what is called the new.

The new husbandry prevails principally in the south parts of the kingdom, and travels but slowly northwards: consequently it must, at present, very much affect the north country farmers, and their landlords in course soon after; for if, by this new method, the south farmer can produce on the same ground, one fourth more profitable grain, grass, and root, in the circle of six years, he will be able to undersell the northern, and consequently the farms fall there in their value.

The same remark may be made in relation to the vale grounds and uplands; for since such great quantities of good hay have been obtained in the uplands, by the assistance of the foreign grasses, this must sink the value of the hay got in the vales.

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The same observation may be made on the the rich dove-bank lands, and others of the same nature, which were formerly so valuable for their feeding of cattle early and well, that they bore an excessive price; but since the many improvements made by lime, by which many other places are brought to feed all sorts of cattle very well, those high-prized lands have sunk considerably in their value.

If the northern farmers should go into the new improvements, as their lands and expence are cheaper than those in the south; they might have the advantage over the south country farmers.

We shall consider the several sorts of grain, grasses, and roots separately, and begin with the most valuable grain, which is wheat.

Wheat is of so an excellent a nature, and of so general use, that it cannot be sufficiently taken care of as to the culture and management: we shall treat of it first in general, as it really is what it is frequently called, the King of grains; and we shall then consider the several sorts of it in particular, and the culture, management, and produce of it; by which the reader will be instructed in its nature, as it is a very curious grain.

Of wheat in general.

Three things chiefly make any thing esteemed amongst men. First, the real use and benefit of it. Secondly, the ease with which it is to be acquired. And, Lastly, the intrinsic excellency of its own nature. All which properties, wheat has in a very eminent degree.

Wheat not only in general supports the life of the greatest part of mankind, but supplies us with numerous other conveniences; affording us strength, health and pleasure. It also makes excellent malt. It grows in almost all countries, and in such a variety of soils, that few places need want it.

As to the ease with which it is to be acquired.

Two things may properly fall under our consideration:

First, the usual labour and expence necessary for the obtaining a crop of wheat. And,

Secondly, The quantity it generally produces.

The expence and labour necessary to procure it, are so well known, that they will not deter the farmers; they being generally so full of the expectation of the profit of it, as to want no encouragement to attempt the cultivating it: depending on the profit of a crop of wheat to pay two years

rent, and the husbandry necessary for the three years in the old course of tillage. The particulars in this respect, will fall under consideration when we treat of the means preparative to it. On a general estimate, supposing two years rent and accidents one pound five; plowings, sowing and reaping one pound five; seed and weeding fifteen shillings; manuring it one pound fifteen. This whole expence would amount to five pounds; and reckoning the farmer to have but four quarters and a half, and that to be sold at thirty shillings, he is paid for all his labour, and has one pound fifteen shillings profit: for the straw is sufficient to pay for the thrashing.

Of the quantity of the produce of wheat.

If we consider what great quantities of wheat have been produced in some extraordinary instances; and what may reasonably be expected from it in a course of good husbandry; what has been before mentioned will appear a very moderate computation of the profits.

“Nothing, says Pliny, is more fruitful than wheat, from one bushel one hundred and fifty are produced; and the procurator once sent to Augustus one grain which had about four hundred stems; and another was sent to Nero which had three hundred and fifty.”

“Among the many contrivances for food, says Dr. Derham, I cannot but attribute that universal aliment, bread, to the revelation; or, at least, the inspiration of the Creator, and conservator of mankind; not only because it is a food used in all or most parts of the world; especially because it is of incomparable use in the great work of digestion, greatly assisting the ferment, or whatever causes the digestion of the stomach.” Of which take this example from the noble Mr. Boyle, “The extracted menstruum from bread alone, that would work on bodies more compact than many hard minerals; nay, even on grass itself, and do many things that aqua fortis could not do: yet by no means was this so corrosive a liquor as aqua fortis, or as the other acid menstruums.” The way of preparing this is deliver’d in Harris’s Lexicon.

We need not go so far back for instances of fertility of wheat. Mr. Evans, of Southampton, had from one corn eighty ears, containing about four thousand grains, some had sixty, and some had seventy grains; and he had on the whole about six and twenty quarters on an acre, when the corn

corn was set at ten inches distance.

Mr. Hamilton mentions, that on trying Mortimer's receipt for steeping wheat in water, pigeon's dung, nitre, &c. though but little of it appeared above ground, what came up branched so, that he could number forty stalks from one grain; and every head was very long, and the grain large; "I planted it, says he, about ten inches distant, I don't doubt if I had given half the seed, that I should have had a very large crop."

There have been several instances of the same nature, but not to insist on extraordinary cases; we know of there being now eight or ten quarters or more on an acre in Cheshire, and in other places, on lands well husbanded and carefully managed. Miller mentions eight or ten stalks from one corn, and eight, ten, or twelve quarters of wheat on an acre as no uncommon thing, both in his own case and in that of others: which he has seen and observed.

This last summer I have taken up wheat both in Hertfordshire and Essex, with eight stalks from one corn; some of which had thirty odd corns in an ear, and some above forty, which some of the owners had never observed, but then counted, and only before thought the corn heavy; fifty to a stalk comes to Mr. Evans's calculation of four thousand for one; and at eight stalks, forty five in an ear, will be three hundred and sixty from one.

The several calculations after mentioned, from the grain when set at different distances, will give the reader a clear notion of what produce may reasonably be expected from an acre of land as differently sown. And we shall only here add the case of Mr. Yelverton in Ireland, who had the reward allowed for the person who should produce the most and best wheat on an acre of ground in that kingdom; by which the reader may see what may be gained by a proper management, in the method that gentleman took in the ordering of it.

Mr. Yelverton in 1742, had the prize in Ireland, having six hundred sixty eight stone and eleven pound of wheat off of one acre.

The method he took was to change his seed; then he sowed it not too thick; and he mowed it.

The seed was steeped the evening before the sowing it in a pickle, and he riddled hot dry lime over it.

The pickle was thus made:

Take rock lime and bay salt, put them together in a large vessel;

vessel: then throw in a sufficient quantity of urine, still stirring them till it dissolve the salt, and slake the lime; let them continue twenty-four hours, and then let the liquor run out into another vessel for use.

The corn should remain from night to morning in this pickle before sowing.

The liquor prevents smut, and destroys a pernicious insect, called the small red worm, often destructive to seed, especially in rich grounds.

In this case the lime and bay salt alter the effects of the urine, which, when used alone, is subject to prevent the wheat from growing. This I have also experienced in some trials of that kind, though at the same time I have found the seed grow when the urine has been mixed with half water.

We shall now proceed to consider this grain in a more particular manner, by tracing it from its origin in the seed to its full maturity. In this course we shall comprize whatever is necessary to be known relating to it under the following heads.

In the first, we shall consider its nature with the manner of its growth.

In the second, what ground is proper for it.

In the third, how ground is to be prepared to be most agreeable to it.

In the fourth, how the wheat is to be prepared for the ground.

In the fifth, how they are to be ordered while the crop is in the ground.

And lastly, how the wheat is to be managed when taken from the ground.

Before we enter into its nature and growth, it will be proper to give a description of it, and to mention the several sorts of it most commonly propagated.

Wheat is an annual plant, tall and slender in the stalk, with grassy leaves and a heavy ear; the root is fibrous, and the stalk hollow. The construction of the ear is this. Each husk is composed of two leaves, or valves, which are of an oval form, and generally contain three flowers. Each flower is composed also of two valves; the outward one belly'd, the inner flat. In this stand three filaments, with little dusky knobs split at their ends. In the center of these is placed the rudiment of the grain. From this rise two filaments, which are feather'd at the top: these catch the
male

male dust that afterwards impregnates the seed. The seed ripens by degrees after this, and the two valves of the flowers retain it till it is separated by time or force.

The several sorts are;

First, white or red wheat, without awns. Second, the red wheat, in some places called Kentish wheat. Third, white bearded wheat. Fourth, red ear'd bearded wheat. Fifth, cone wheat. Sixth, grey wheat, in some places called duck-bill wheat, and grey pollard. Seventh, Polonian wheat. Eighth, many ear'd wheat. Ninth, summer wheat. Tenth, the wheat called naked barley. Eleventh, six rowed wheat. Twelfth, long ear'd wheat. Thirteenth, white ear'd wheat.

These are strictly seminal variations, not distinct species; nor are several of them of any moment; but we thought it proper to mention them all in a work of this nature.

The first six commonly grow in England; but the first, the fourth and the fifth, are the best worth cultivating; being hardy, and affording a great quantity of flour. The cone wheat is to be preferred to all, as having a larger ear and fuller grain than any other, and it is the kind most sowed near London.

Some prefer the third on account of the extreme whiteness of its flour, and some the bearded, as thinking it less subject to mildew; but of this there is no certainty.

The Polonian wheat is little cultivated now to what it was formerly; nor is there any reason known why it is omitted.

The eighth is little cultivated here, tho' much in Italy and Sicily: some stalks of it have seven ears, and it has commonly three or four. This often occasions its being laid.

The summer wheat is sown in the spring, and is ripe as soon as the other; but not producing so great a quantity of flour as the others, it has been neglected, though it may be proper when the other miscarries.

The tenth sort is little cultivated, the grain being thin, and the flour coarse; but it is hardy, and will grow upon any soil.

The six rowed wheat is not very common, the ears are short, and have each six rows of grains in them.

The twelfth sort is cultivated in several parts of England, and more in Wales; the grain is pretty long, but not so full as some other sorts, it has a greater quantity of chaff, and the awns of it are as long as those of rye.

To

To these we shall add the following varieties.

1. Egg-shell wheat; this is reckoned best for light lands, and to be mixed with rye for massin, it being early ripe.
2. The double-eared wheat; this prospers best in a heavy clay, or a loamy soil.
3. The red or Kentish wheat; this is much sown in Hertfordshire.
4. The great-bearded wheat, which thrives well on a heavy clay.
5. The white pollard wheat.
6. The flaxen or lammas wheat.

Egg-shell wheat is reckon'd the best for yielding the whitest flour, and making the best bread; it will grow well in a loamy earth, and in gravelly, chalky, and sandy loams; it suits light lands best, and is generally early ripe.

As to red lammas; as wheat is the king of grains, so this has been esteemed hitherto the king of wheats. It grows best in the richest vale lands, or on blue clays, where I have seen it near five foot high: it is sown also by many in up-land dry loams, and even in some gravels, that have been before dressed extraordinary well. This is that noble sort whose kernels are somewhat longer than perky wheat, and near as big as cherry stones. When sown in a right soil, will outweigh perky, but it turns not out so much flour. It is six inches taller, and so is subject to fall.

Yellow lammas has a white straw, and a red ear; the flower is near as white as that of the other lammas; it will grow on chalks, gravels and clays, and other poorer lands better than lammas.

Perky has a white straw, a white ear, and a red or yellowish kernel, more round than the lammas. It comes into repute as it will do well in chiltern grounds, chalky and gravelly soils, well dressed; it will grow in poorer ground, and turn out well, and is not so subject to blight. The vale farmers now find it yields more than lammas, is hardier, and will grow in a courser tilth, and will do with less dressing. It bears late sowing best, and is fit to be sown after artificial grasses, pease, beans and turnips with one plowing.

White wheat has a white straw, and a white thick ear; its kernel is as big as perks. It grows closer together than red lammas, and so is better secured from blights. It has also two or three chaffs, which secure it against flies. It thrives well in inclosed, poor, gravelly, chalky and light loamy soils; and is much sown and mixed with red or yellow

low lammas : it weighs lighter, but makes more flour than the perks or lammas. Bakers mix them. It will grow well both in vale, swampy and stiff soils, and in chiltern dry grounds.

Duck-bill or dugdale wheat has several other names, and has a darkish brown guttery kernel, rather bigger than other wheat ; the chaff, by its sharpness, hurts the horses mouths. It is sown in vale chiltern ground, in wet and dry loams, which are made rich with manures, for a poor soil agrees not with it ; it is bulky and subject to fall, but folding on it makes it stand.

When sown on a fine well dressed tilth, it produces a great deal of grain ; its flour is of the coarsest and heaviest sort ; it may be sown in October, and even to February or March you may sow any of the perks or white wheats.

There are several other good wheats in different parts of the kingdom, known under various names ; and several of the above-mentioned sorts are called by different names in various places ; several of them are also so mixed in sowing, that many large farmers are not acquainted with the diverse separate sorts, or their proper names : nor is there any objection made to their mixed corn when brought to Bear-Key.

That called cone wheat is a good sort, but the London Bakers think it too sweet ; they buy it in flour, and whiteness being a great article, they prefer the red wheat, and mix them, if necessary. Those who will not go to the price of the best, put in allum, which gives the bread a whiteness, but a poor dry taste.

The Persian wheat may be mentioned as a curiosity, it having five heads on one stalk, one in the middle as long as the ears of our wheat, and two on each side about an inch long ; it is raised sometimes in the gardens of the curious : Mr. Hamilton planted some of it on his coldest soil in Scotland, having first mix'd unslacked lime with horse dung prepared some time before, with the earth it was planted on, which brought it to its full maturity.

All farmers agree that some of these sorts of wheat thrive best on strong stiff land, and others do best on a light soil ; so that the farmer must suit his wheat to his soil, or prepare his soil to suit the grain.

There is frequently a great variety of soils in lands lying together ; nay, in one and the same close at a little distance ;
sandy

sandy soils on the one side, stiff on the other, wet and oozy in the middle.

We shall proceed to treat of these, but first consider how corn grows.

Experiments have been made on several grains; and seeds of various species have been caused to vegetate in the air, without any aid or assistance from the earth.

The seed on these occasions is laid on wool, spread on a plate with holes in it; on the mouth of a larger vessel filled with water.

I have tried the experiment with a brown pot full of holes, placed over, or rather in a larger vessel near full of water; the warmth of the sun raises a quantity of wet into the air; which, in this case, must pass through the holes in the brown pot, and so keep the wool moist. And it is also found, that all water so carried up, conveys some earthy particles.

In a few days the wheat, grains, and seeds will begin to vegetate; and extend, by slow degrees, their roots towards the water, where they imbibe, however, a less quantity of juices than they would from the earth. Yet they will prosper in that situation.

When a seed has been two days in the earth, the juices with which it is swelled are imparted to the bud, and cause it to grow.

The bud is situated in one of the extreme parts of the seed, and that part which lies nearest the surface is the small root of the future plant.

The substance of seeds consists of two pieces, generally called lobes, and which at first are united by one common covering; the structure whereof is more or less solid. These after separate and serve as seminal leaves of the plant, and then they wither and decay when the plant has no farther occasion for them; and these observations may soon be made of divers species of beans and pease.

The bud of a grain of corn which has been lodged in the ground, begins in about four and twenty hours to burst its foldage, and to disengage itself; after that it shoots out its roots and stem.

The root at first is inclosed in a sort of a purse, through which it breaks its way: two other roots within the space of a few days shoot forth from the sides, and each of them bursts through the covering wherein they were infolded.

These three roots are shagged with a vast number of filaments, which wind themselves about the little clods of earth

which they meet with in their progress. By this close adhesion they draw whatever is nutrimental to the tender plant. The stem shoots upwards in a perpendicular line.

Corn will begin to shoot a small verdant point out of the ground in five or six days.

This little stem is no more than a small parcel, or packet of leaves folded one upon another all round the ear; which remains for some considerable time invisible, and is lodged in the heart.

Tho' the first leaf of this packet opens a little toward the point, yet the lower part is always confined, and rolled up in the hard teguments from whence it springs.

Some few days after, the covering of the seed begins to waste away, and the purse wherein the roots were contain'd, decays and dies when it has performed its offices.

When the leaves are duly unfolded, we may perceive the first draught, or imperfect sketch of four tubes, which form the stem; and at the bottom we may likewise discover the bud of the ear.

From the first knot which lies nearest to the roots, shoots out a leaf, which performs the function of a covering to a second tube; at the third knot begins another leaf, which covers the fourth tube and the ear.

The interstice between the first and second knot nearest the roots, is then much larger than that which separates the second from the third.

On these tubes thus jointed as it were or set one into another, the ear rises; which may be distinguished with ease by its round transparent grains, which bear the resemblance of so many little pearls.

At length the ear shoots from the foldage which screened it from the air, and the several bags which are appointed to contain the substances of the future grains, begin to be dilated.

These shoot out slender bodies for the reception of the powders from the chives, which make their appearance above, and render the buds prolifick.

When the buds have dilated in those lodgments; that mealy substance to which they are united by several filaments, the foldage and the first leaves, which extracted from the earth and air such juices as were proportioned to the delicate structure of the stem, begin to waste away.

The stem then operates more powerfully, it exhausts from the leaves their nutritious juices to enrich the ear.

It

It is matter of admiration, that so valuable an ear should be supported by so tall and slender a stem; planted in the midst of an open field, where the winds have full power to plow it down.

This stem often ascends to the height of four or five foot from the ground; and though it has no more than two twelfths of an inch for its diameter, yet it is contrived according to the strictest rules of good oeconomy; for by this means a small field will contain an infinite number of ears.

The stem, however, as slender as it appears to be, has been formed with such art and ingenuity, that it is thereby preserved for several months successively unhurt; notwithstanding its being openly exposed to storms and tempests, and to all the various fluctuations of the air.

Four knots of a hard substance resembling the same number of strong bands, make it as firm as it is necessary, without rendering it in the least unpliant: it is flexible enough, and qualified to bow without breaking not only under a common gale of wind, but even under the shock of the most sudden and impetuous blasts.

By the assistance of its knots it is enabled to recover its first position, as soon as the storm is over; and it is a very agreeable sight to view this forest of ears under a gentle agitation of the wind: each successive breath of air makes them bow in their turns, and seem to roll along the field like the waves of the ocean.

The ears are formed with no less art and judgment than the stem; the grains which are in them are ranged one above another, at equal distances, in order that they may receive an equal proportion of nourishment and support. They are also concealed and secured under various teguments, which are thick enough to break the force of the sun's beams, and are so closely joined together, that they can exclude and throw off those dews and rains which would otherwise oblige them to shoot out.

Several of these teguments terminate in as many points of different sizes; which are ducts or channels, intended to introduce into each lodgment a sufficient quantity of air.

I am apt to believe these points, or beards of corn, are designed to withstand and break the force of those heavy drops of rain which fall upon them; by which means they are discharged from each side, and from the surface, instead

of penetrating to the bottom of the lodgments of the various grains.

The process of nature in the vegetation of plants, as exemplified in a grain of wheat, is as follows.

The first day the grain is sown it grows a little turgid, and the husks gapes in several places, and the body of the plant swells, and the gem or sprout opens and encreases, the roots begin to bunch out, and the placenta, or seed leaf becoming loose, gapes.

The second day, the secundine or husk, being broken through the stem or top of the straw, appears on the outside, and grows upwards.

The third day the pulp of the conglobate, or round leaf, becomes turgid with the juice it has received, from the earth fermenting with its own.

The stem from whitish turns greenish, the lateral roots break forth greenish, and the lower roots grow longer, and hairy, with many fibres growing out of it.

Hairy fibres hang all along on all the roots except on the tops, and these fibres wind about the particles of soil like ivy, whence they grow curled; above the lateral roots two other little ones break out.

The fourth day the stem, mounting upwards, makes a right angle with the seminal leaf, the last roots put forth more, and the other three encreasing have more hairs, which closely embrace the lumps of earth, and where they meet with any vacuity, unite into a kind of network; the leaf is now softer, and when bruised yields a white sweetish juice, like barley cream.

The fifth day the stalk still rising puts forth a stable leaf, which is green and folded, the roots grow longer, and there appears a new tumour of a future root; the outer husk, or sheath, is loosened, and the seed leaf begins to fade.

The sixth day, the stable leaf being loosened, the plant rises upwards, the sheath still cleaving round it like a bark; and the seed leaf is sinuous or wrinkled, and faded.

After the eleventh day the seed leaf, as yet sticking to the plant, is crumpled and almost corrupted, within it is hollow; and about the secundine, the mucus and white substance of the seed being continued to the navel knot, form a cavity; all the roots becoming longer put forth new branches out of their sides. The second leaf withers, and
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its vesicles are emptied ; the spaces between the knots grow longer ; new gems appear ; and the middle root grows several inches longer.

After a month, the roots and stalk being grown much longer, new buds break out at the first knot, and little tumours bunch out, which at length break into roots.

The roots which grow are generally according to the goodness of the ground, and the compass allowed for the grain of corn to extend itself in ; Miller says, he has traced a root to the extent of a yard, which is farther than I could ever trace one ; but with the allowance which may be proportionably made for the very fine threads, which could not be taken up. I think I have found some extend two foot in length or near it.

Four, five, or six stems are what is commonly to be met with in the usual course of husbandry ; each contain, if tolerably good, from thirty to forty grains or upwards ; as I have counted them this summer both in Hertfordshire and Essex.

I have sometimes met with eight stems from one grain, in corn sown in the common way which is about three hundred for one ; but that is not usual. We shall have occasion to mention this again when we come to compare the different produce arising from various grounds, and from grain sowed at different distances, in one and the same grounds ; we now shall proceed to our second head ; that is,

How the ground is to be prepared for wheat.

This being a point of the utmost importance to the farmer, requires a particular consideration ; especially as the new husbandry gives a quite different method of management in this matter ; and more especially as some new ways of proceeding in this article have very lately been introduced, and are just now struck out by some ingenious farmers, which very well deserve to be set before the reader.

The usual method of preparing the ground for wheat, was formerly by plowing it three, four, or five times, and dunging it when necessary. This, in general, answered very well, when proper regard was had to the nature of the soil, and the different seasons which happen ; since it has been found, by repeated experience, that both frosts and snows have great influence on corn land, both in respect to the necessary plowing it, and also as to the certain enriching it when the snow falls and lies on it,

Frosts, when to any moderate degree, lightens the ground so much, that the usual plowings have a much better effect on it for wheat; and when it continues any time, it makes the last plowing unnecessary, or indeed improper for some sorts of ground. Miller is of opinion, that the ground for many years after the great frost, required less plowing than it did before.

Frosts not only lightens the earth, as before mentioned, but makes it more susceptible of the air, which certainly not only conveys an unaccountable quantity of rich nourishment into the soil; but by its working power still loosens and lines the particles of it after a very extraordinary manner; for tho' it may be hard to say what it is, or however difficult it may be to name or describe it, the beneficial effects of it are found beyond dispute; which are so great, that some writers and farmers are of opinion, the great benefit of plowing is to make the earth more capable of receiving the air and dews; the truth of which every one may be convinced of, who will consider the riches acquired by fallowing. It is common to see, in many places, land worn out with tillage, made again proper for it, by only lying some years uncultivated.

A proper fineness is necessary; but this, in many cases, might be effected without many plowings.

The air, rains, and dews, are replete with great particles, which have surprizing effects both in and upon the earth, and in and upon vegetables.

Dr. Hale found, that a cubic inch of blue clay being distilled, an hundred and eight cubic inches of air were raised from it.

The air is very operative in every part of nature; whether animal, vegetable, or mineral.

Common air is frequently impregnated with noxious vapours, thus the fumes which ascend up in the air from fermenting wines are pernicious, and those from burning brimstone deadly.

It is by the amphibious property of the air the principal operations of nature are carried on; for a mass of mutually attracting particles, without being blended with a due proportion of repelling ones, would soon coalesce into a sluggish lump.

Mr. Boyle mentions to what a great number of miles an inch of air may be rarified, and the force of fire engines are visible now in most countries.

If any person has a mind to see the effect of water expanded, he may just wet a bullet mould, and then pour in a little boiling lead, which will fly out with prodigious force; I have seen it strike into a solid stone, but whoever tries it must be careful to secure themselves, and all about them, from the danger of its flying on them, if the hole be toward them.

We see the great power of expanding water, when heated in the engine to raise water by fire; and water with air and other active particles, in capillary tubes, and innumerable small vesicles, doubtless act with great force, though expanded with no more heat than what the sun's warmth gives them.

Pease in a pot near full with water, on imbibing the water, have raised one hundred and eighty-four pound weight laid on them; by which we may see the vast force with which swelling pease expand. And doubtless a considerable part of the same, is exerted not only in pushing the plume of a plant upwards into the air, and enabling the first shooting radicle of the pea, and other grain, and all the subsequent under fibres, to penetrate and shoot into the earth.

Though we have from these experiments, and common observations, many proofs of the expansive force with which the fibrous roots of plants shoot; the less resistance they find, the greater progress they will certainly make in equal times.

Hence one of the most considerable uses of plowing, fallowing, and trenching, and of harrowing of ground, and of mixing composts, is to loosen and mellow the earth, that not only the roots may make easier shoots, but there may be a freer and readier admission of the dews, rain, and air.

Notwithstanding this, a proper stiffness of the soil, suitable to the grain sowed, must also be preserved; otherwise wheat, and some other grains, will fall. To prevent this, farmers frequently roll the ground when necessary, and sometimes fold the wheat with sheep.

Could we find out what stiffness each grain requires, and the degree and sort of rich nourishment most suitable to them, tillage would be managed with greater ease, with much more certainty of success, and with greater profit.

These are brought to a tolerable degree of certainty, as to the nature of lands proper for wheat, beans, and some other grains; and some general rules of fitting lands by

proper quantities of marle, lime, chalk, soot, and ashes, are pretty well ascertained; yet there is still a large field open to the thinking farmer, for the better proportioning his manures to his lands.

It may not be improper to caution the farmer, against over-manuring his land; for when land is made too rich, he will not meet with a good crop of corn, but is sure to find a plentiful one of straw. This is the reason why farmers, when they are to break up rich land, generally first take off the edge of it (as they call it) by first sowing it with oats, before they sow it with wheat; and a very good farmer assured me, that he had lost above fifty pounds in his younger years, by making his wheat land too rich.

Marle, lime, chalk, and salt, are in themselves excellent preparatives of the ground for wheat, when properly applied; but what is peculiarly beneficial in these is, that they convey no seed of weeds, no insects or pernicious vermin, but rather destroy them.

For example, clover, which is an admirable preparative for wheat, requires no such culture or manure, as will give any annual or other weeds an opportunity of running to seed; if the farmer should lay a little fine dung on it at Michaelmas or in February, yet the clover being almost perpetually mowed first, either for seed or grass, that early mowing will cut off any weeds which may get in it, before they can seed. As the tops of clover are generally large and flourishing, they overshadow and keep down weeds: if any sown should be conveyed by such a manure, the clover tops, and deep roots, will mellow it before it is plowed up for wheat, for which one plowing is commonly sufficient.

The same may be said of turnips, whose large head overshadows and keeps under weeds; and the repeated hoeings necessary, clear the ground, at the same time that their large roots are sold to great profit, or prodigiously enrich the soil, and frequently answer both those purposes.

Beans and pease are also excellent preparatives for wheat, And here I shall mention a very extraordinary instance in the course of husbandry, begun by a farmer near Chelsea, this spring,

He sowed his ground with pease in rows as usual, at about twenty inches distance; and when the pease were grown up a little, he sowed the interspaces betwixt them with turnips, and after let the pease rest on the tops of the turnips; he after reaped the pease, and sold part of the turnips;

turnips; and on the twenty-second of this October I saw two teams plowing this ground; one of which, with six horses drawn double, plowed up a furrow of eleven inches deep, and twelve broad; and the other, with two horses, followed and plowed the rubbish about two inches deep, turning it, and all the remaining turnips, into the bottom of the great furrow.

Many of the turnips plowed in were very very large, and few less than apples; the servants told me their master thought the turnips would be as good as half a dunging, and he intended to sow it as it now lay, and then to harrow it. There was no appearance of any rubbish on the top of all that was finished by the plows.

What the success may be cannot be foretold, but in this procedure, there appears all the substantial benefit of horse-hoeing, as well as of giving the wheat that distance, which we are promised will procure us such advantageous crops; the furrows being a foot distant from each other, betwixt which most of the corn will fall, after whatever manner it is sowed.

From this experiment, a judicious farmer may take several hints which may be of great service, in other articles.

Lentils, and several other grains and grasses, are very good preparatives for wheat, when plowed into the ground, or eaten on it, which different farmers order according to their inclinations; and all may be of use for wheat, as will be mentioned when these articles come to be considered: wheat does not well follow common barley, as it makes the land too light, and also takes too much of its goodness from it: it seldom does well, tho' the ground be in good heart.

I shall mention one article more under this head, which is that of plowing.

The Herefordshire farmers plow five times for wheat, shallower or deeper as occasion requires: and all agree it is improper to plow in rain or snow.

The mode of plowing ought to be varied according to the nature of the soil, and the early or late sowing. And it is a common saying, sow early and have corn, sow late and have straw.

There is another common rule said to be a standing one in husbandry, viz. The more thorough the greater the crops; which may be admitted as far as the soil is more broke and made finer by that means. But it occasions the seeds to fall closer to each other, and so far it disagrees with
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the modern method of sowing less seed, and at a much greater distance than is usually done, which is now so much preferred to all other ways.

About Dunstable they plow much in fitches; and in Essex some very good farmers practise this method with great success; making five fitches when they come to sow, which five make a perch; so that between every two fitches there is a thorough a foot wide.

They sow these fitches length-ways by hand, and a person used to it will sow for two teams, each of which plows an acre and an half a day; and when they have done the necessary plowings, they run a small plow drawn by a single horse, along every thorough, which casts the fine mould and corn each way on the fitch, and leaves the thorough clean.

By this method, and sowing sparingly, they apprehend they have all the advantages they are promised by the drill plow; and the benefit of their wheat having sufficient room for its growth; especially as there are so great spaces left at each side of the fitches.

Pliny mentions the plowing ground eleven times, which is thought strange; but there are two good farmers here who have several times plowed their ground as often: and as soon as the ground is cleared from the corn, constantly apply the plow to it, and repeat it every fortnight or three weeks, whilst the weather will allow, in order to give the earth the benefit of the sun, air and dews; and to extirpate and prevent the growth of weeds, which grow best at this time. By this repeated husbandry they have cleared their grounds so well from weeds, that I this year saw fields of wheat without a weed in the sheaves, or one growing in the field: and one led his wheat immediately after it was shorn. By this method they never have any smut or blighted corn; though one of them uses no steeping: and the land is so mellow, that two horses and a man plow an acre and half a day with great ease; so that in reality, they have no more trouble than those who plow less with stronger teams, and a boy to drive.

How the wheat is to be prepared for the ground.

Under this head there are two things to be principally regarded.

What sort of seed is to be procured; and what quantity is necessary. And next, how that seed is to be ordered.

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The usual allowance for wheat has been named already; whoever approves of the drill way of sowing, ought to sow less seed than is commonly allowed to an acre; as it comes nearer in appearance to the drill method of husbandry, which allows the greater advantages to the seed of more room for the sun, air, dews, and rain; and greater compass to spread the roots in the earth. In the common way of sowing, regard is to be had to the time: a peck less will do in September than after; and a peck more than common is required in gravelly, and new broken up grounds: great allowances must be made in some places for the damage done by vermin, which frequently devour or carry off the seed, whilst others are spoiled by lying exposed to the severity of the weather.

The succeeding calculations of what produce may reasonably be expected from wheat sowed at several distances, may probably give the reader so clear a notion of this matter, as to guide him in his conduct.

Why may not wheat be hoed at such distances as the owner pleases, as well as turnips? Is not the same reason that satisfies us of the prudence of our conduct in the one, as strong and forcible in the other? The farmer before named spoke of hoeing his wheat as well as his turnips; but he has not yet ventured to cut up what I would call the superfluous wheat; though he finds the hoeing it not only to answer as to the clearing off the weeds, but also as to loosening the surface, and refreshing the wheat. Sure the hoeing wheat to eight or nine inches distance, could be no hazard of making it too thin; and this near the thoroughs would answer the distances proposed by those, who seem desirous to allow the largest compass of ten or twelve inches for each plant to spread in.

Why might not the spare wheat in one place be transplanted to vacancies in others; or even to fresh-ground prepared for it?

A good hand with a trowel would transplant several hundreds in less time, and at a less expence than most readers would imagine; and wheat may certainly be transplanted very well: I named a trowel, because that when it opens the ground for the wheat, hardens not the sides of the holes as setting sticks do, but leaves the earth looser for the wheat root to strike fresh in.

Every farmer knows wheat will bear mowing at proper seasons without prejudice. It will bear trampling on by sheep,

sheep, when folded properly upon it ; and the roller is frequently also usefully applied ; and I know it will bear being transplanted, and if prudently done at a proper season, and in ground suitable for it, a man would presently transplant an acre at a foot distance : the hazard could not be great, and the profit of its succeeding would be very considerable.

As to the choice of seed, few have that care in this particular which they ought to have ; for much more certainly depends on good and proper seed, than most persons think.

Corn growing on virgin mould, or new broken up ground, is best of all ; and where that cannot conveniently be had, it is adviseable to get seed from some distant place at least once in two years ; or if from land in the same neighbourhood, let it be from different sort of land.

Mr. Yelverton of Ireland, had his seed from England ; but wheresoever the seed is taken or brought from, take particular care that it be perfectly clean and sweet. It is generally agreed, that the largest and fairest of the sort should be chosen for seed ; as usually producing the most, the largest, and the best ears of corn : which rule generally holds good.

Another article is making the seed clean from seeds of weeds, and filth of all sorts, as well as from bad grains. In this case a little pains at first, will save a great deal of trouble afterwards, as to the keeping the ground clear, as well as from bad and smutty corn.

Of steeping seed wheat,

This relates not only to seed wheat, but to many other sorts of grain and vegetables.

We have mentioned the composition used by Mr. Yelverton ; and shall add that used by Colonel Plummer, another successful raiser of wheat. But as to the many compositions which have been much cried up, and sold at a great price ; they have seldom given satisfaction.

Col. Plummer of Hertfordshire's way of steeping wheat.

Wash the wheat through three or four waters, stirring it well each time, and skim off the light grains. Put water in a tub with a tap, with as much salt as will make an egg swim ; then add as much more ; stir it well, and put in two or three pounds of allom beat fine, and stir it again well. Use it as ordinary brines, only steep the wheat thirty or
forty

forty hours: for less signifies nothing. Take the wheat out the night before you sow it, and sift some flaked lime on it. And add fresh quantities of the ingredients as wanted.

A good way is to steep the seed in rain water, in which bay salt is mixed, till it will bear an egg, for thirty hours; and after to spread it on a floor, with fine lime mixed with it, and stirred together till each seed leaves clinging to another, and till it seems candy'd with lime.

There are other receipts given to the same purpose; and that which Mr. Ellis seems to value himself much upon, mentions the dissolving three pounds of copperas in two or three gallons of scalding water; stir it till it is dissolved; and, when just warm, pour it over two or three bushels of wheat. A quarter of an hour after pour over all the wheat seed, as much dunghill water as will make the whole swim four inches; and stirring it sufficiently, you may skim off all the seeds of weeds, and the light thorns that occasion smut and pepper wheat.

The seed is to lie in this twelve hours; then draw all clear off, and lime it directly for sowing the same morning: or if the seed lay and drained twelve hours first, it would be better.

Of sowing wheat.

The time for sowing wheat in general, is from the middle of September to the beginning of December; but some sorts, and upon some particular occasions, others may be sowed at different seasons.

In general great regard is to be had to the nature of the land, and the weather; dry land may be sowed with care in moist weathers (though not in wet, if it can well be avoided) and stiff wet land is only to be sowed in a favourable time, for fear of the seed being lost: it is much the best to sow the seed in fresh mould, and for that reason they commonly sow as soon as ever the ground is made ready to receive it.

The sowing the broad cast way is very well known; but the sowing of wheat by hand, sowing or spraining the seed in along the stiches, as was before mentioned, and as they frequently sprain in pease, is not so common; though this latter manner seems to come the nearest setting in rows: or sowing according to the drill husbandry.

The next thing to be considered is,

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How the wheat and the ground are to be ordered whilst they are together.

The first care is to get all the crows gutters and thoroughs well cleansed, and the loose mould and corn in them cast upon the plowed ground; for which purpose a small plough is used in several places, which is easily drawn by any horse, and contrived to throw the loose mould and corn on both sides, and leave the thoroughs perfectly clear and smooth to let the water run off.

After this there seems three things necessary to be considered under this head:

First, what is to be done when the wheat is too forward or rank, which would endanger its being laid and spoiled.

Second, what is to be done when it is too poor.

Lastly, the keeping it clean from weeds. This last is a calamity the best husbandmen often suffer by; since the seeds of weeds are frequently carried by winds and by birds; and often lie concealed years in the soil.

When wheat is too rank, it is sometimes proper to mow, sometimes to eat it, and sometimes to fold sheep on it. This last is not only an advantage this way, but also for the improving the ground, not only by the dung and urine of the sheep, but by the fining of the mould by their treading it with their feet; and the nourishment conveyed by the warmth of their bodies.

As to refreshing the ground when too poor, by additional improvements; the folding answers that end very well; and, in other cases, the sprinkling on a few bushels of foot, malt dust, pigeons dung; or any thing of that kind will answer the end desired, or even fine mould or dung mellowed: especially if the wheat be hoed as before mentioned, which alone would answer the end of refreshing the wheat very much, as well as help to keep down the weeds.

Weeding the growing corn in the common way, by cutting up, or drawing where it can be done without prejudice, helps to make the ground sweet and clean, gives the grain more room to grow, and to receive the benefit of the air, the warmth of the sun, the fertilizing dews and rains. Further, it makes the reaping the corn cheaper, and saves a great deal of trouble in every article.

But this is only a temporary help, not reaching the root of the distemper, which lies deeper.

We have mentioned the benefit of hoeing of wheat; and this

this summer I saw the advantage of it, when performed with a small hoe, and a skilful hand : this destroys most of the roots, so that all annuals were destroyed ; and those of a more lasting nature, prevented from doing any more mischief that season : the fruit of this hoeing was, I saw not one weed in a whole field of wheat this season, at the reaping.

The reader must not expect the same success on one hoeing, or weeding ; since this farmer had for some years industriously extirpated all weeds, and carefully avoided every thing which he thought could occasion their growth ; such as the carrying dung with weeds in it to the ground. Notwithstanding which, he frequently observed a new growth of weeds when he plow'd deeper than usual, or near the hedges.

These remarks are conformable to the observations of the late Mr. Ray, who observes, that many seeds will grow when kept several years, and most when kept more than one ; and that several sorts had been kept fourteen years, and some buried so long in the ground, and yet grew when brought again into the open air and sowed.

These remarks will give the farmer an insight into the origin of weeds, and put him on carrying his thoughts further, in order to obtain a remedy.

There are two sorts of weeds, annuals and perennials.

Annual weeds will be easily managed, if care be taken to prevent their seeding.

As to the perennial, the same methods will in a great measure procure the same present advantage ; but as they will grow again, and many of them will spread, there is no effectual remedy, but extirpating them by a common dock spade, used for drawing up docks, or destroying them by exposing them to the heat of the sun, or severity of the cold, the former of which is the most effectual ; or else by harrowing them off on plowing, and then burning them.

In some cases other remedies may be applied : I have known salt brine in Cheshire poured on walks to destroy weeds, and scalding water will take the same effect.

Where salt water is near it may be applied for this purpose, especially for destroying weeds on dunghills or composts ; but care must be taken not to apply too much, for fear of the over-salting it, and preventing the growth of the corn or grass for some time ; the farmer may safely
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pour an hoghead of sea water; on every such quantity of manure as he designs for an acre of land, which will kill the weeds on the dung, and enrich the ground.

Where the corn is sowed in drills at a proper distance, it will not be difficult to clean it from weeds by hoeing; but care must be taken, that the weeds are tosd; or laid so that they grow not again.

How the wheat is to be managed when separated from the ground.

Here it will be proper to mention the different methods of managing corn whilst in the field, used by the north and south country farmers, with their respective reasons for their conduct.

In the north counties, at the evening, they set up eight sheaves, close in two rows, and then cover them with two large sheaves half opened, and then draw over the tops of the others, which shelter the whole like a thatched cover, and will protect all for ten or twelve days or longer: in case of excessive rains the wet sides of the two covers will suffer, but very rarely any other part: and it must be a continued long series of very ill weather, if the farmer has not an opportunity of housing his corn well.

In the south they set up twelve or twenty sheaves in two rows, without any cover, which they say helps to whiten the wheat; but if any violent rain or wet happen, all their corn suffers.

Where corn is very dry and clean, I have seen it carried away as thorn; but the more usual method in both parts of the kingdom, is to let it stand some time in the field to make it whiter, and to ripen any part which wants a little weather; and also to kill grass or weeds which may be yet amongst the corn, and which may be prejudicial to it when in the barn.

However different these sentiments of the farmers may be, all good ones agree, that it is wrong to house the corn too soon; and better to err rather in the other extreme, it being almost a proverb, "It is better to spoil corn in the field than in the barn."

The next thing is the mowing it close in the barn, or setting it on a stack out of doors; in both which cases it is difficult to guard against vermin, though some are very dextrous in what they call mowing the mouse out of the barn: but the setting it on posts, or stones capped with
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others, which reach over the first on every side, is generally found the best. Corn may thus stand several years sweet and good. And in some parts of Staffordshire, and some other places, they make their stacks round, a circle being the most capacious of all figures, and the most secure against storms, breaking the force of them gradually; whereas the square ones receive the full force of the wind and wet, and all the inconveniences attending them.

However careful the farmer may be, mice will sometimes get into his stock, and are frequently carried in the sheaves out of the field, and are soon of very ill consequence. It may be known if they are there, by thrusting an ash pole, or poles, pretty far into the stack, which the mice will eat the bark of; for mice will eat the bark of the branches of several trees, and the tenderer the bark the greater the temptation, and the easier it is done.

The immediate thatching, or otherwise securing the stacks till thatched, is very expedient; and is often delayed in harvest to the considerable prejudice of the farmer, which might be in a great measure prevented at a little expence, by moveable covers, as was formerly mentioned.

The price of thatching, where labourers have one and sixpence per day for doing the whole, is usually ten-pence for an hundred square foot.

Threshing is the next thing to be considered. This is generally performed the best and easiest in warm dry weather, or in frost; for notwithstanding the barns are kept as close as possible, the grain is found to quit the husk the best in those seasons, which shews what influence the weather has, even where it would not be expected to occasion any sensible alteration.

The common price for threshing, cleaning, and putting wheat into the sacks, is two shillings a quarter, where the labourer's wages are fourteen-pence per day at that season, and it must be proportionably less where wages are less. But good or bad corn makes a difference as to the work, and will have its influence also on the wages; and so will the quantity of grain in the ears, some having above forty, some above thirty, and so on. Care must be taken the corn be not damaged, when threshed by lying on a damp floor too long, before it is cleaned or carried off.

There is a great difference even in the article of cleaning corn between the south and north country farmers; the former cleaning it by casting in the barn, from one end of

it to the other, the best flying farthest, and then separating and cleaning it again after, by the wheat ridler, or fan; whereas the north country farmers perform this by wind, which generally does it very well; and in defect of that they have a fan with sails, turning on an axis, which does the business effectually.

The next thing is to send the corn to the market, if the price be agreeable, or to keep it in hopes of a better: where any person is of ability, and has an opportunity of keeping corn when it is cheap, he has a fair prospect of promoting his interest; corn generally bearing double the price if one crop miscarries, which it generally does once in four or five years. The Dutch have frequently bought our corn, and sold it again to us at double the price.

He who saves corn in plentiful years, may be called a publick benefactor, as really promoting the publick good. For it has often been lamented, by wise and good men, that we have no publick granaries, to supply us in a time of scarcity.

The countries most famous for abounding in corn heretofore, were Thrace, Sardinia, Sicily, Egypt, and Africa.

When Augustus had reduced Egypt, he took peculiar care of the bed of the Nile, which by degrees had been clogged with mud, through the neglect of the Kings of Egypt, and caused it to be cleaned by the Roman troops whom he left there. From thence came regularly every year, twenty millions of bushels of wheat. Without this supply the capital of the world was sometimes in danger of perishing by famine.

When Severus died, there was corn in the publick magazines for seven years, expending daily, bread for six hundred thousand men.

Constantinople was supplied in the same wise manner, when the empire was fixed there; and an admirable order was observed in both those cities, for the subsistence of the immense number of inhabitants.

Constantine caused fourscore thousand bushels of corn, which came from Alexandria, to be distributed daily at Constantinople: this was for the subsistence of six hundred and forty thousand men; the Roman bushel serving only eight persons.

To give a later instance of the effect of magazines, after the fatal battle to the French at Blenheim, the French generals waited on the King, with an intent to get his directions

rections how to recruit their forces, none of them venturing to name the great distress they were in. The King asked if his publick magazines for his soldiers were full, and being answered in the affirmative, he ordered them to take care that they were kept so. And soon after they found the effects of that provision, for there being a scarcity in general, and good provisions made for the soldiers, the army was supplied without compulsion.

These instances will convince us of the wisdom of keeping of corn; and also that it is possible to do it for many years, which is next to be considered.

There are various methods of preserving corn, which may be considered either as they relate to publick granaries or magazines, or as they concern and are the property of private persons. As there is at present no appointment of the former with us, I shall only just mention two or three particulars about them; and then come to what is within the compass of private persons, and what may be of advantage to those who are desirous to promote their own and the publick good at the same time.

Varro assures us, corn would keep good fifty years, when shut up close in the ear in subterranean caverns, which they covered on all sides with straw, to defend it against damps, closing the entrance with great care.

The method of preserving corn in the ear is still practised, when it is to be sent to far distant places. And it is sent after this manner to America, in casks perfectly well stopt up, otherwise the substance will evaporate, and the plantation of it prove ineffectual.

Another method is to clean and dry it well, and remove it once in fifteen or sixteen days, for half a year; then if it is laid up dry it will need little more care.

After two years good preservation it may be kept forty, fifty, or a hundred years, by lodging it in pits which are covered with strong planks well joined together; or, which is a more secure method, by covering the surface of the heap with a small quantity of quick-lime, and then dissolving it again by sprinkling a little water upon it. This quick-lime will cause the grain to shoot two or three fingers in depth, and form a surface or incrustation, which is too strong to be penetrated either by the air, or insects.

In some cities abroad they have receptacles for preserving corn in the town walls, particularly at Leghorn, which being close stopted, kill vermin, and keep the corn good.

As to preserving small quantities for four or five years, which, in general, is long enough for private persons in this country, the keeping corn in a stack set upon wooden posts of stones, with caps over them, has been found abundantly sufficient to answer, the preserving the corn good, and the bringing profit to the owner.

As to the farmer's wanting the straw for his ground, and the chaff for his horses, these are considerations too trifling to be set in comparison with the advantages proposed by the keeping of corn, especially in corn countries, in which the straw is little valued in plentiful years, and the chaff less.

It is common with farmers to keep corn in bags, and a great quantity may be secured in hair bags in a little compass, and placed so that cats may also keep the place clean, if kept in common sacks.

About Hemsted they put five bushels in a sack, which is about three hundred weight, which strong fellows are hired to carry up into the repositories.

Where full sacks are used in rooms or granaries, I have observed a commodious little machine used for conveying them from place to place, by which I have seen twenty quarters of corn delivered out with great ease in a very few minutes.

Some place their wheat, when threshed, in the chaff, in the midst of a stack of corn in which it will lie in a comparative little compass.

The most effectual method is to have a granary raised on posts, or stones capped, for corn stacks: this, if contriv'd as malt-houses are, with several floors, the corn may be easily removed, when necessary, from one to another, readily downward; and, by proper pullies, with no great difficulty, to the highest; and, by such removals, kept perfectly clean and sweet as long as desired.

The place where corn is kept ought to be free from damp and all moisture, as well as from ill smells of all sorts; all which soon give a tincture to the grain, and make it musty, ill-scented, or ill-tasted.

Few who have made any observations, but know how soon good or ill smells are communicated from one body to another, when placed near together. Coffee gives a tincture to tea, when near it. The faculties of many of those diminutive creatures which destroy corn, are much finer than ours, and therefore several herbs and compositions may keep them from touching it: some things being im-
mediate

mediate death to them, which we scarce perceive. Dry wheat ought to be placed in a clean sweet place for keeping, and it will not be right dry for the purpose till after March.

The substance of all the methods for preserving of corn is much the same, to have what is good, sweet and dry at first; and to keep it from air, wet, and vermin after.

As to vermin, the washing the walls and floors with bitter herbs and drugs, with leaves of wormwood, vinegar, and beasts galls, is serviceable; and where they are used, weavils or worms will seldom bite; the ashes of green oak are said to kill mites when spread on the floor.

We before mentioned the power of lime slacked in this respect; and brimstone seems to have an effect beyond every thing of this kind. When a little of it is taken inwardly, it will communicate a smell through the body to the cloaths; and, if applied outwardly, will colour money in the pocket.

A calculation of what seed wheat is required when sowed at different distances; and of what produce may be reasonably expected from each respective method.

An acre of ground contains four thousand eight hundred and odd square yards; and in the following calculations, I shall compute it by even numbers; that is, by five thousand yards to be sowed; and making allowances for thorough, headlands, and other accidents, shall reckon four thousand yards to produce corn: we speak here only of the common old methods of husbandry.

An ounce of wheat may be computed to contain six hundred grains; and there being sixteen ounces in a pound, there will be nine thousand six hundred grains in a pound: there being about sixteen pounds in a peck of wheat, there will be one hundred fifty-three thousand six hundred grains in the peck: reckoning a bushel of wheat at sixty-four pounds.

An acre of wheat set at twelve inches distance, allowing seed for five thousand yards, will take forty five thousand grains, that is not quite five pounds or the twelfth part of a bushel.

When the grain is set at eight inches distance, it requires double the number of seed: that is, eighteen to a yard, being ninety thousand grains, not near a peck of wheat.

When the corn is set at six inches distance, there will be thirty-six grains in a yard, and one hundred and eighty thousand grains in an acre.

And when it is set at four inches distance, there will be eighty-one in a yard; and in the whole acre, four hundred and five thousand, not three pecks of wheat. Reckoning one hundred fifty-three thousand grains to a peck of wheat; and ten pecks of wheat, which is the common allowance of seed to an acre, as we usually sow the ground, there will be one million five hundred thirty-six thousand grains of corn to an acre; and so there will be near four grains sowed on every square of four inches; that is, almost a grain to every two inches square, or four cubic inches.

The product of wheat when good, is about five quarters, which is sixteen times the seed that is generally sowed, which is a better produce than they had formerly in many places. We are informed by Cicero and Pliny, that ten for one was the highest produce of an acre, but the ordinary produce was eight, with which the husbandman was well content.

The ears of wheat usually contain from thirty to five and forty grains each; and taking forty as the middle produce, and allowing twelve stems to each grain of the corn set at a foot distance, which is as much as they will bear without the benefit of horsehoeing: and reckoning four thousand yards to produce corn, then each stem producing four hundred and eighty grains, there will be in the whole thirty six thousand times four hundred and eighty; which in the whole will be seventeen millions two hundred and eighty thousand. And there being six hundred fourteen thousand four hundred grains in a bushel, there will not be quite forty bushels in an acre so set at a foot distance, with the supposed produce of twelve stems to each grain, and forty grains to each ear.

When the grain is set at eight inches distance, there will be double the quantity sowed; that is, eighteen grains in each yard, and eight stems to every grain of seed, the number of seeds will be seventy-two thousand; which, being multiplied by three hundred and twenty grains arising from eight stems, the produce will be twenty-two millions and forty thousand, which is about a fourth part more than what was supposed to be produced from the seed sown at a foot distance, this being somewhat above six quarters to an acre.

When

When the grain is sowed at six inches distance, with an allowance of six stems to grow from each grain, there will be one hundred and eighty thousand grains of seed ; that is, thirty-six times five thousand.

As there will be four thousand yards that will bring corn, and each yard has thirty-six grains of seed sowed on it, and each stem forty grains, that is, two hundred and forty times thirty-six, multiplied by four thousand, makes thirty-four millions five hundred and sixty grains of corn, which is a third more than arose from sowing at eight inches distance ; and, consequently, above nine quarters to an acre.

When the grain is set at four inches distance, and four stems are allowed to arise from each grain for four thousand yards, there will be eighty-one times four thousand seeds to be reckoned to produce corn ; and then there will be in the whole three hundred and twenty-four thousand seeds, which being multiplied by one hundred and sixty times, each arising from one corn with four stems, and each stem supposed to bear forty corns, the whole will make fifty-five millions eighty-four thousand, which will be near a third part more than those set at six inches distance are supposed to produce ; and three times as much as those produce which were set at a foot distance, and would be near twelve quarters, which have been frequently obtained in the common way of sowing.

If we should enter into the consideration of grain when sowed closer than four inches, we shall come into that uncertainty of the distance which falls to the share of each grain in the usual methods of sowing.

All these calculations suppose the common method of husbandry to be used ; we have shewn before the quantity procured by corn set at a distance and horsehoed.

The reader will not think that these calculations are to be depended upon as exact : they are only made to give him a general view of what may reasonably be expected from setting corn at several distances ; and will be found as near the truth as can be expected in an affair of this nature ; in which the writings and practice of others have been of little service to direct me ; but which I have endeavoured to collect from some rules in husbandry pretty well established, and from some rules of proportion.

If these calculations be tolerably well founded, then the sowing wheat in stitches by hand, as before mentioned, at four, five, or six inches distance in the rows, and in the

same proportion in other cases, may perhaps, considering the unavoidable loss of many seeds, and vacancies of many places in all fields, be as good a rule to go by, as any can be given in general, for those who will not use the horsehoeing method: for, whatever may be said of the great extent of some roots of wheat in depth and breadth, four or five inches either way will be a good allowance when the ground is not till'd between.

One advantage may arise from transplanting wheat, which may not improperly be added to what was before said on that head; which is, that by this means the farmer may have an opportunity of giving his land to which the corn is to be brought, the advantage of more plowing; and also the benefit of the winter frosts and snows, which are exceedingly advantageous. What the ingenious Dr. Beal says on this subject, cannot but make a deep impression.

“ I often ask gardeners and husbandmen whether all
 “ sorts of land are more fertilized, or more speedily by the
 “ solar influence in our climate, or by frost; and they ge-
 “ nerally answer, that frost and snow make the quickest
 “ dispatch amongst us, and the more general and richer for
 “ fertility*. Such a transplanting of wheat, may, in all
 probability, be often a great advantage to the wheat itself;
 for whenever that is too rank, it must be eaten or mowed
 down, or will be spoiled. But the removal of it will give
 a proper check to its growth, without any prejudice to
 the wheat.

From the brining or steeping of wheat, or other seeds, the following advantages are proposed.

First, that it will make the seed grow, and come up pretty much together; and consequently, be ripe together.

These often happen otherwise when the seed is not steeped, as part of it may fall where it may sprout soon, and part lie long in the ground before it does sprout. In case a long dry season follows such sowing, some seeds, as barley, and others, may not come up at all, or in such a manner as quite to spoil the crop.

The second advantage, is the securing it against birds, and vermin, and from its being spoiled by smut. And,

Lastly, 'tis said the seed steeped in proper ingredients imbibe a fertilizing richness from the prepared liquor; or from

* *Philos. Transact.* vol. II. p. 231.

from the lime usually cast on, and adhering, at the time of the sowing it.

That salt and lime, which are the ingredients most used on this occasion, when properly applied, are great fertilizers of land, is too plain to need proof: and that they are destructive of vermin, is also found by the constant experience.

All housewives know how effectually salt preserves provision from the taint by vermin; and the very smoke of a lime-kiln effectually clears all who engage in it, from the vermin they were before afflicted with; I have seen caterpillars drop from gooseberry trees, under which a little lime was flaked for a trial.

The question is whether such imbibing of the brine, or other liquor, or the lime so adhering to the seed, shall be really a sufficient future security of it against vermin and smut, and be a fertilizer of it in its growth.

We have undoubted proofs of the long continued effects both in smells and tastes arising from a very short application of one body to another; which we may reasonably presume to be the case of brines, soots, copperas, and particularly of brimstone, and other ingredients of the same nature: and the general use of one or other of these by most farmers, seems to confirm the advantages reaped by them.

Good and bad crops are undoubtedly got both with steeping and without, the advice some give to keep the ground clean and sweet, and to till it well, is certainly very good, and ought to be pursued by every sensible farmer, whether he steeps his seed or omits it.

Many are strenuous against sowing the usual quantity of seed, and favour the drill husbandry; but if little seed be sown, and nothing done to secure that little against voracious birds, and destructive vermin, I doubt they would soon make such devastation, as would leave many vacancies free from any corn at all.

There is an objection against steeping, which is, that when corn is brined and sowed in a dry season, the brined seed frequently grows mouldy and decays when not covered. But the steeping, if done right, will set it on sprouting, and it will then struggle hard to live: and it certainly is in as great danger of being devoured when not steeped, by lying open, as of growing mouldy from being brined. But the usual quantity of corn sowed will abundantly supply such
little

little accidents: and this very objection seems to shew, that the steeping preserves it from vermin, when it is suffered to lie uncovered without being carried off by birds, or devoured by insects.

A regular steeping will certainly produce the sprouting of the seed, which is the first advantage proposed by it.

This advantage cannot be hoped, unless it be steeped in a proper manner; for throwing a little urine or salt water over the seed is so far from obtaining this end, that it will rather produce the direct contrary, by occasioning those grains which happen to be brined, to vegetate sooner than the others which are not.

It must be a regular brining of the whole that can produce a regular vegetation of all; and it is undoubtedly on this account, that in all sensible receipts for brining, an industrious and repeated stirring of the seeds in the steeping liquor, is earnestly pressed.

The washing the seed in fair water, directed in some of the receipts, seems to me prejudicial to the end proposed by steeping it. The seed can imbibe but a certain quantity of liquid, and if it suck first fair water, it cannot after retain so great a quantity of the steeping liquor as it would otherwise do; and probably this might make it necessary for Colonel Plummer and others to make their brines so strong, when as good an effect would have been found by a weaker, applied in the first instance.

And as to the clearing of seeds from light corn, as salt water is specifically heavier than fresh, that refuse would rise better on the brine than in fair water.

In regard to the danger of seeds bursting, if sowed in a wet time, or if a wet season soon follow, that danger may be easily and safely guarded against, by enuring them gradually to gentle degrees of moisture, according to their nature; and then committing them to the open earth, which I have tried successfully in several instances. If we once knew what degree of moisture any grain or seed will bear at first, without receiving of prejudice, it can be no great difficulty to use them in the manner they are able to bear at first; and then commit them to the open air, which they must be sometimes hazarded in, whatever method is taken in the management of them.

It seems plain from experience, that many seeds may be made certainly to grow, and that equally as to their time of sprouting, by steeping, which was the first advantage

vantage proposed; the next thing to be considered is, the securing it against birds or vermin, or from its being spoiled by what is called smut.

The steeping of seed was known in Virgil's time, and that with proper ingredients, to secure it against destructive vermin long since. For Sir Hugh Plat in his garden of Eden, (Page 61, 62.) mentions lime beaten to powder, and mixed with corn before it be sowed, to prevent rooks and other fowls from devouring it, and puts a question, if it does not also help to enrich. In another place he mentions, the laying pease in water a day or two before they are sown, and puts a question of steeping in milk, spirit of wine, or water that hath been long infused on dung, waste soap ashes, or common ashes, whose salt hath not been drawn out before.

All this has, by repeated experience, been found to be right: and most farmers now use one sort of brine or steeping composition or other for several sorts of grain: we may presume, that so general a practice, and the advantages procured by it when properly managed, will sufficiently justify the proceeding in the same course of husbandry; for I do not find it objected, that vermin still devour the corn.

As the methods of steepings and brinings are numerous, and various, it is next to an impossibility to chuse out such as will fit all the different sorts of grains and soils, but they all do, or should point at the same end. That is, to convey something to the seed disagreeable to vermin; and which at the same time may fertilize or enrich them. We will consider the former as it falls under this present second head. And the latter, when we come to the third. To do justice to steeping, we shall consider,

First, the reasonableness of the procedure; or the grounds we have to believe that it will secure the grain when sowed.

Then those consequences which repeated experience hath taught us generally to arise from such steepings.

Most creatures have a sense of what is agreeable or disagreeable to them, and avoid the latter; this is plain, when foot is laid round vegetables; which, whilst fresh, keeps off vermin.

It is evident, several compositions are fatal to one or more species of creatures, which effect not others at all.

Lime, salt, smoak, and brimstone, are death to many insects.

Oil of turpentine, or smoak of tobacco, will kill moths; and, at the same time very little affect us, or many other creatures

creatures. Rubbing of hangings and furniture with sheep's wool before it has lost its fatness, will stop the progress of moths, but it does not occasion any manner of uneasiness to those who lodge in them.

As sheep's wool has this effect in this case, may it not be reasonably concluded, that it will operate much stronger against vermin when the sheep lies on them in the fold. Folding of sheep destroys slugs and worms, and there is the same reason to expect the effect in one case as in the other.

The faculties of these diminutive creatures are much finer than ours, both as to their smelling, and their being affected by scents. But the curious smell which dogs have, would appear surprizing were it not so commonly known.

Fumes of brimstone will make leaves wither. And to animals are most deadly.

Dr. Hale says, he is told that it is by such methods, that all the rats in ships are destroyed when in the harbour. And he farther observes, that the fumes of burning brimstone, placed under corn, will ascend through it with great velocity and acrimony.

Indeed, the effects of brimstone are scarce credible by those who are unacquainted with it; and we have reason to think greater effects will be discovered from it hereafter.

I shall add on this head, the surprizing effects of the liquor used by the bug-killers. A house was long pester'd with bugs, and the bug-killers took down all the beds and furniture, and washed them, and the walls of the rooms with his liquor, and then re-placed them: it is now above three years since, and from that time there has not been a bug seen in the house. Nor was the operation attended with any ill smell, or other sensible inconvenience to any of the inhabitants, the dogs or cats. Nor did the ingredients stain any thing, or prejudice the frames of pictures.

Why may not something of the same nature be contrived to be proper, safe, and effectual securities for the grains and seeds, in fields and gardens, till they are armed against these great little enemies.

Several farmers put arsenic into their brine for wheat, and apprehend it beneficial; but this is a detestable practice.

This may, in a great measure, convince us what consequences may arise from proper steeping the grain.

All the things commonly used alone, or in compositions for steeping seeds; such as salt, lime, foot, copperas, nitre, flour.

flour of brimstone, dunghill water, bay salt, and urine, are generally supposed to have a power to destroy animals pernicious to seeds, or at least to preserve the seed from being devoured by them; or else to be endued with such a fertilising quality, as to forward the sprouting and growth; and most of them certainly have one or other, or all the last-named qualities.

Seed also steeped in proper ingredients imbibes also a fertilising richness from the prepared liquor, or from the lime usually cast on it, and adhering to it at the time of sowing it.

The truth of this will, in a great measure, appear from the general course of husbandry, in applying manures in order to promote the vegetation of seeds and plants; by which some particular advantages are proposed to be obtained by the consent of all farmers. And therefore it may be taken for an indisputable truth, being founded on reason, and confirmed by constant experience, that the growth of seeds is to be forwarded by the application of proper manures.

Particular manures suit particular seeds; pigeon's dung is richer than cow dung; and a load of any creatures dung feeding on animals will encrease vegetables much more than a load of dung of cattle fed on straw.

It remains to shew, that the steeping so short a time as is usually practised, may convey a lasting benefit to the growth of the seed so steeped.

In the work of fructification I think (says Sir H. Plat) corn itself may be so philosophically prepared, only by imbibition in the philosopher's aquavitæ, that any barren ground, so as it be in nature kindly for corn, shall bring forth a rich crop, without any matter added to the ground*. Digby mentions a plant of barley rising from one corn, that by steeping and watering with salt petre dissolved in water, brought forth two hundred and forty-nine stalks, and above eighteen thousand grains. Another gentleman had from three spires of steeped barley sixty, sixty-five, and sixty-seven stalks apiece from their single grain and root, with every one an ear on, and about forty or somewhat more corns apiece in them†.

Other instances of later date might be added; but they are not necessary.

* Garden of Eden, p. 173.

† Philos. Transact. Vol. IV. 2d part, p. 310, &c.

This sudden growth of a plant must either be owing to the simple unfolding of the infant seed, or to the operation of the composition used for the increase of it; therefore proper compositions applied to vegetables but for a small time, may, and do oft convey a very fertilising power toward the growth.

A short steeping may convey such a lasting fructifying or fertilising quality, as will be of a continued service to the growth of the plant.

We find several things much more incomprehensible of lasting impressions made in a very short time.

The touch of a loadstone conveys a lasting impression to the needle.

A little bud from a striped holly, put into a large green holly, will gradually occasion the whole green one to become striped.

Other instances might be offered, particularly of the wonderful effect of poisons.

We farther find it appear from experiments, and it has been evidently proved by Dr. Keil, that the growth of a tree very little lessens the weight of the earth in which it stands. Mr. Boyle had ground dug up, and plants only watered with spring water; one weighed three pound, and one fourteen, and the earth was scarce diminished: Helmont dried two hundred pound of earth, and planted a willow in it of five pound weight, which he watered with rain, or distilled water, and covered with a tin cover; and in five years the tree, and all the leaves it had borne, weighed one hundred sixty-nine pounds three ounces, and the earth was diminished but about two ounces.

May we not from these, and other experiments. reasonably suppose, that steeping compositions may help to expand the unfolding plant, and make it more readily receive additions to its substance from the air and dews.

However this operation is performed, there cannot be any doubt of the truth, since there are single things and compositions which forward the growth of grain and plants, by being applied to them, or by the grain or seed being steeped in them as is seen on tryal.

The only thing now remaining to be considered, is whether the brines or compositions commonly used, be proper to obtain the end, or which of them are likely to be of the greatest service.

We

We should enter into a large field, were we to mention the innumerable receipts which are to be met with, and enlarge on their benefits and disadvantages; but we shall only add, to those before mention'd, two or three of the most noted relating to seed wheat, and then consider which of the many ingredients may be the most likely to obtain the end.

The copperas receipt.

Put a tap and tap whips into a tub, and then put in two or three bushels of wheat.

Take three pounds of copperas, put it into two or three gallons of scalding water, which will presently dissolve it.

Let it cool a little, and then put it all over the wheat; a quarter of an hour after, pour over all as much black dung-hill water as will make the whole swim four or five inches; then skim off all the light bad corns.

In this liquor let the seed lie twelve hours. Then draw all clear off, and drain it twelve hours before liming.

The steeping used by Middlesex farmers.

At night put a quantity of water in a tub, with a tap, then put in five bushels of seed wheat for two acres of ground; stir it well and skim off the seeds of weeds, and of all light corn; then draw off the water and take out the corn.

Put more water into the tub, and a pint of salt, and a pottle of stone lime, which with good stirring will soon break: then put the wheat in again, and stir the wheat, and the lime, in the liquor very well together, and let them lie so till morning.

Then draw off the watery part, and lay the wheat on an heap on the flour to drain dry, which it will soon do, ready to be sowed.

If the kernels have not lime enough about them, sift on more; but they have, this way, generally enough lodged on them.

Another receipt.

Throw bay salt into rain water till it will bear an egg; in this liquor steep the seed thirty hours.

When you take it out spread it on a smooth flour, scattering upon it good store of the fine ground powder of flaked lime;

lime; sweep this up and down, and mingle it with the corn, till every grain leave clinging to another, and become as it were candy'd with lime; then sow it.

Malt fumed very strongly, and being then ground and brewed, gives no ill taste to beer.

Sea biscuit, pease, and wheat, fumed in a large vessel, and repeated again after ten days, will get little ill taste. Exposing them for some time to the open air, will free them from the very little taste it gives.

But it is not adviseable to fume corn thus which is intended to be sown.

In the philosophical transactions the following experiments are mentioned.

On the twenty-second of March, 1699, a gentleman laid to steep a barley corn and a wheat corn in brimstone water; a pea, a wheat, a barley, and an oat corn in allum water; and the same in a dissolution of salt of tartar; in the caput mortuum of sal armoniac, dissolved in urine; in a dissolution of the salt of walls; in a dissolution of salt petre; in a dissolution of noston, or star gelly.

He steep'd them five days and five nights, and set them in a garden in a good soil, against a north wall, full in the sun, on the twenty-seventh of the same month, after a rainy night, with a pea, a wheat, a barley, and an oat corn unsteeped.

On the tenth of April following, he found that some were just come up, some not.

The pea, the barley, and the wheat steeped in brimstone came up all together.

The pea steeped in allum water was very big and swelled, but had not so much as sprouted; but the barley, wheat, and oat above ground.

The pea steeped in the solution of salt of tartar was half come up, the wheat scarce sprouted, but the barley and oat quite up.

The pea, the wheat, the barley, and the oat steeped in the caput mortuum of sal armoniac, dissolved in urine, were all up together; as were also the next row, that were steeped in the solution of salt of walls.

The pea and wheat steeped in the dissolution of salt petre were about half up, but the barley and oat quite up.

Those which were steeped in noston, were none of them come up, or scarce sprouted.

The

The barley and oat steeped in urine were come up, but the pea and wheat scarce sprouted. And to his surprize the pea, wheat, barley, and oat that were not at all steeped, were all of them as soon up as any of the former except the wheat, which was about half up.

They were all set about a finger deep in the ground, and there was all the time of their growth very fine weather.

From this he supposes allum water is against the nature of pease, and retards their growth, but agrees well enough with wheat, barley, and oats.

That the solution of the salt of tartar is not friendly to the nature either of pease or wheat, but agreeable to oats and barley.

That the water of salt petre had not any of the great power or virtue that he expected.

And that these steepings did not further any of the said grains in their growth and coming, but plainly retarded some or most of them.

In all these last experiments the seeds were steeped five days and nights, which is much longer than any other steepings practised that I know of.

I rather wonder any of them came up at all, than that some of them miscarried; for several seeds will do well when steeped a few hours, or a day or two, according to their nature, and the strength of the liquid, which yet would be spoiled by being steeped longer.

We may reasonably conclude, that those which came up when steeped so long, would have succeeded better had they been laid less time in the liquids: and therefore we may reasonably hope for success, by prudently trying some of these mixtures again, or varying them.

The urine, as mentioned, seems tolerably successful, but in several tryals I have made, it has destroyed the vegetative power of wheat, and several other seeds, in less than five days. There may be a difference as to the strength of urine according to different diet.

Much the same may be said about the fuming with brimstone, before mentioned, to be twice repeated, and then attended with ill success, as to the vegetation of the wheat; Which probably might have grown, if it had been sowed after once fuming. I am the more induced to believe this, because we find, in the last mentioned experiments, that all

the grains which were steeped five days in brimstone water came up together.

As brimstone seems, from its piercing qualities, strong and lasting smell, and frequent violent effects, to promise fair for being useful in this particular, as it is found to preserve bread and corn; the curious would do well, to make proper trials of it in different ways and manners. This may be done at a trifling expence: but the nature of brimstone requires they should be careful.

In several trials I made, I kept the seeds twelve, four and twenty, and thirty-six hours in the same liquid, and sowed them severally at the times taken out of it; and I have found generally, that wheat, turnips, coleseed, and many others, will grow freely after being so steeped in sea water, fresh water, or in fresh water salted equally to the degree salt water is; which is made so by dissolving an ounce of common salt in a quart of common water.

In the last mentioned experiments, the unsteeped grains came up near as soon as those which were steeped; but that is nothing extraordinary, considering that he sowed them after a rainy night. For I have several times observed, that the steeping a day or two before sowing, in moist weather, is no great advantage as to the forwarding the sprouting of the grain. The reason is the fair water being finer, the seed imbibes it quicker than that made thick by the mixture of such ingredients as are commonly used on these occasions.

Perhaps the long steeping the seeds which is used, might occasion the stopping of the passages of the grain in its sprouting. It is hard to say, with any tolerable certainty, which steepings and brinings are the best, for the several grains and seeds they are commonly applied to: to ascertain them in a very exact manner, the nature of the soil, the season of the year, the species and kind of grains and seeds, the several sorts and different quantities of the ingredients to be used, and the length of time they are to be applied, ought to be carefully considered.

In the common steeping of wheat in sea water, or in water in which salt is dissolved, and the time the seed is to lie in it, there is nothing certain yet agreed on. Some think the saltness of sea water sufficient, others would have their brine strong enough to make an egg swim, and others advise to put as much more salt again as would make an egg swim.

There is as great uncertainty as to the time of the seed lying in the brine, various directions being given about it, some naming four hours for the best time, some forty, and others different times between those two: not to mention that great variety of ingredients commonly mix'd with brine, and how they operate jointly or separately, used severally by various persons; to omit the different management of the seed after it is taken out of the liquid.

They are much mistaken, who imagine the liming to be only to make the seed sow better: I apprehend both the lime and the salt adhere to the seed, and not only guard it by their taste and sharpness, as long as their virtues remain, but also communicate some of these their properties to the growing plant, and occasion a ferment in the earth.

Upon the whole, lime and salt may be safely and plentifully used in steeping and brining of wheat.

By careful experiments, this manner of brining may be brought to a reasonable certainty, as to the general practice. And perhaps the wheat itself may be found, when rightly ordered, to imbibe such quantities only of each ingredient, as will best answer the ends desired; and at the same time to refuse such overplus, or such kinds of juices as may be prejudicial to it.

It will be proper to avoid using ingredients alone, which are too strong for wheat, such as urine, when not diluted: and not to keep the seed so long in any composition, as may rob it of its vegetative quality.

Lime and salt are undoubtedly excellent ingredients, and so are several other things directed in some of the receipts for brining above-mentioned; and if brimstone can be brought to be useful in these affairs, either alone or with other ingredients, both the smell, the piercing quality, and great power in the destroying of vermin, seems to promise fair for its being very serviceable for the preserving of the seeds.

Of Barley.

Barley is esteemed the next useful grain to wheat, and ought to engage our second care.

On the success of the wheat and barley in the corn countries, farmers generally depend for the payment of the principal part of their rents, and for the happiness of themselves and families; the other grains being expected rather to pro-

vide conveniencies for themselves, and to maintain their stock, than to raise any great sums.

Barley hath a thick spike; the cup, husk, and flower, are like those of wheat or rye; but the awns are rough, and the seed swells in the middle, and for the most part ends in a sharp point, to which the husks are closely united.

The great use of barley is to make beer.

In some counties they make bread of it, but it is coarse and unpleasant.

It is also useful to be given to the several sorts of cattle, and for the feeding of fowl.

It is far more beneficial most ways, when made into malt; for it is then so sweet, and endued with so fattening a quality, that few things exceed it. And the use of mashes made of it for horses, and other cattle, are very well known. This shews the fine spirit which is originally in the grain, since neither the steeping, or the drying it for malt, can take such a quality to it.

The use made of it by the distillers, shews the spirit that is in it. There is some difference amongst writers, as to the names and sorts of our barley; Ray mentions three kinds.

1. *Hordeum distichum*; common barley.
2. *Hordeum distichum minus*; sprat barley, or battle-door barley.
3. *Hordeum polystichon*; winter, or square barley or bear barley, called in the north, where it is commonly sowed, barley big.

Mr. Lawrence mentions four remarkable sorts of barley. First, the long-ear'd, most generally esteemed for all uses.

Second, the sprat, or Fulham barley, which is best for rank land.

Third, the hotspur, or Rathripe barley, commonly got in, in nine or ten weeks. This is useful on many accounts, for that reason, as it may be sowed later, and will ripen in those places where the others scarce will grow: it gives the farmer the command of some weeks, either before the sowing it, or after the reaping, which is often of a very great advantage in the course of husbandry. He may eat his turnips longer, or sow later with this barley than otherwise. There are also instances where two crops of this barley have been got in one year, from the same land.

Fourth,

Fourth, Scotch barley, which gives the drink made of it a taste disagreeable to strangers ; and a purging quality.

Miller mentions five.

First, the common long ear'd barley:

Second, winter, or square barley, or bear barley, by some called big.

Third, sprat barley, or battle-door barley, as Mr. Ray.

These, he says, are commonly cultivated near London ; but unthinkingly, in the next page, adds, that the square barley, or big, is chiefly cultivated in the north of England, and in Scotland ; but seldom sown in the south of England, though it might be cultivated to good purpose, on some strong, cold, clayey land : which is true.

The other two sorts cultivated in England, are, the Rathripe barley, before mentioned. And,

The naked barley, which makes tolerable good bread, and very good malt, and yields great increase.

All these sorts of barley are to be sowed in a dry season, but at different times, according to the nature of the soils, and the sorts of barley. It may, in general, be sowed from the beginning of February, but rather in March and April ; and the Rathripe will bear sowing in the beginning of May.

Barley has the shallowest roots of all the white corn, and yet stands firm.

It will not grow in many soils where wheat will. A stiff earth is not proper for it, unless it be brought into an exceeding fine tilth.

From the ingenious Dr. Hale's calculation of the violent heat and evaporations in the summer months, and the small quantity of dews which then fall, and the little further supplies which are given to trees, corn, and vegetables, frequently for a long time together by rains, vegetables would be dried quite away were they not supplied with moisture from some other origin : this he reckons to come from the moisture in the earth two or three foot deep under the trees.

Since these experiments have gained such a character, I doubt not but the substance of those which relate to this particular, will be agreeable to the reader ; especially as I shall only give the result of his several calculations, as I have abridged them. " If these experiments and obser-

“ vations, says that author, give us any further insight into

“ the nature of plants, they will then doubtless be of some
 “ use in agriculture and gardening, either by serving to
 “ rectify some mistaken notions, or by helping further to
 “ explain the reasons of many kinds of culture, which
 “ long repeated experience has found to be good; and,
 “ perhaps, by leading us to make some advances therein,
 (P. 360.)

“ For, the farther researches we make into this admirable
 “ scene of things, the more beauty and harmony we see in
 “ them: and the stronger and clearer convictions they give
 “ us of the being, power, and wisdom of the divine ar-
 “ chitect.” (Introd.)

The growth of vegetables is promoted by the motion of their fluids; and in them also, by the same method of inquiry, considerable discoveries may be made, there being in many respects, a great analogy between plants and animals.

This author has examined their several perspirations, and found that a man perspires in twenty-four hours, about thirty-one ounces; and an equal plant, allowing for evening and morning, twenty-two ounces: so a man is to a flower, as one hundred and forty-one to one hundred, in this particular.

He further found that in one and twenty days in summer, there were near six and twenty ounces more wet evaporated from a circular area of a foot in diameter, than fell in dews: and therefore justly concludes, “ That plants would
 “ then perish, if they had not some other fresh supplies,
 “ either from rains, or from below; finding the evaporation to be four times as much as the dews that fall in the night: and we know by experience, that for much longer time often no rain falls.

On the whole he reckons about two and twenty inches of rain to fall in his neighbourhood, near Hampton Court, in a year; which may be reasonably allowed, considering the several quantities, which, on the nicest calculation, have been computed to fall in several places, as computed by Dr. Derham, || being the result of many calculations, as follows:

“ The proportion therefore which I shall now lay down
 “ for the yearly rain of all places, whose rain I have had in-
 “ formation of, are these.

“ For

|| Philos. Transact, vol. IV. part II. page 32.

“ For Zurich (till further observations are made) thirty-two inches and a half.

“ For Piza (till further observations) forty-three inches and a quarter.

“ For Paris nineteen inches.

“ For Lisle twenty four inches.

“ For Townley in Lancashire, forty-two inches and a half.

“ For Upminster, nineteen inches and a quarter ; all of English measure.”

Dr. Hale further mentions, that Nic. Crequius found that twenty-eight inches depth evaporated in a whole year from water ; and the evaporation of the earth is found to water as one thirteenth to one fortieth ; about one third.

The evaporation of the earth in a year is 9-15. (something above nine inches) from which 9-15 inches, there are to be deducted 3-39 inches (above three inches and a quarter) for circulating daily dews ; and then there remain 5-76 inches (five inches and three quarters.) Which 5-76 inches deducted from the quantity of rain which falls in a year, there remains at least 16-24 inches depth (sixteen inches and near a quarter) to replenish the earth with moisture for vegetation, and to supply the springs and rivers.

Hence we find two and twenty inches of rain in a year, is sufficient for all the purposes of nature, in such level countries as this about Teddington near Hampton Court.

But it plainly appears above, that the evaporation in summer frequently far exceeds all the dews and rains which fall then for a long time ; and, consequently, the heat would then destroy all plants, unless provided for some other way.

In order to find out what stores of moisture nature had provided in the earth, against the dry summer season : the last of July 1724, the doctor dug up three cubic feet of earth, three foot deep (and mentions the soil, &c. of the place.) And when those several three cubic feet were become so dry as not to be fit for vegetation, on weighing them several times, he found the first foot (the highest) had lost six pounds ten ounces of its one hundred and four pounds four ounces, being the original weight. That the second had lost ten pounds of its original weight of one hundred six pounds six ounces and a half. And that the third had lost six pounds ten ounces of its original weight of one hundred eleven pounds and one third. Which together

amount to twenty five pounds two ounces ; and the doctor apprehends this a sufficient reservoir for plants in general, in dry summers and dry times : for several plants strike deep into the earth, the root of the sun-flower he made the experiment with, reached fifteen inches into the earth ; and, consequently, would draw moisture much deeper in dry times than the depth its root reached.

It is necessary also to consider the heat of the different times of the year, and how far that may effect the generality of plants ; and what they can bear, before they will be burnt up and destroyed.

The doctor observes, plants will bear without prejudice a greater heat, than that when water is heated to the greatest degree, he could bear his hand in without stirring it about ; and mentions the following degrees of heat at different times :

“ That in July the common noon-tide heat in the sun is about fifty degrees.

“ That the heat of the air in the shade in July, is at a medium thirty-eight degrees.

“ That the May and June heat is from seventeen to thirty degrees, which is the most general heat for the generality of plants in which they flourish most, and make their greatest progress in growth.

“ The autumnal and vernal heat may be reckoned from ten to twenty degrees : the winter heat from the freezing point to ten degrees.”

“ In July the heat must have a considerable influence at two foot deep, by night as well as by day.

“ The dew in a hot day cannot be of benefit to the roots, but is imbibed into the vegetables.

“ And nature has covered roots with a very fine thick strainer, that nothing shall be admitted into them, but what can readily be carried off by perspiration ; vegetables having no other provision for discharging their recreation.” (Page 85.)

Since a plentiful perspiration is found so necessary for the health of a plant or tree, it is probable many of their distempers are owing to a stoppage of this by inclement air.

The perspiration of men is often stopped to a fatal degree ; and that of vegetables by inclement air, unkindly soils, or want of a genial moisture.

By comparing the root, and the part of the plant above ground, we see the necessity of cutting off many branches from

from a transplanted tree; for half the root being cut off, it has but half the nourishment, besides its being put in a more loose position.

This strongly evinces the necessity of well watering new plantations.

How the ground is to be prepared for barley; and of steeping and sowing it.

Barley requires as fine a tilth, and the ground to be in as good heart as any white corn whatsoever. Accordingly, before turnips came to be so much cultivated, the ground was generally prepared by a fallowing, a manuring, and several plowings. And the vale men, who get no turnips, use much of the same husbandry, or else fold it with sheep, or get twenty bushels of pigeons dung, and spread it on an acre; when the barley is sowed, and harrow it in with it.

Since turnips have prevailed so much, they are found to prepare the ground very well for barley, and now it is commonly sowed after them.

Care must be taken to provide good seed, and the change of seed yearly, or once in two or three years, is very advantageous. In the case of barley, that from sandy short loam is found the best for stiff land, and that from stiff for sandy.

In light soils it may be sowed early in March, or any time after; but in stiff not till April, and sometimes not till early in May. In such late sowing, if the season does not prove favourable, there is hazard as to a crop; and it will be a late one.

Of steeping barley.

Whatever the season is, a moderate steeping of barley, cannot be attended with any inconveniencies, and may produce great advantages; almost any of the steepings mentioned for wheat will make it grow.

The vale men steep it in salt and water in which an egg will swim, twelve hours; and some in water in which lime is dissolved, or they sift dry lime over it.

Rathripe barley is soon ripe; and there is little danger in sowing it late. But there will be the more occasion to steep it.

The common allowance for seed barley is from four to two bushels to the acre; according to the time of sowing, the sort of grain, and the nature of the soil. Taking three bushels

bushels in the medium, the produce being four quarters, it will be about eleven for one. Whereas if only one half of the three bushels grew, and produced but two stems, that would be sixty bushels, which is twenty times the seed; and I have known some large fields to answer this calculation.

A late writer applies here the common saying, "The more furrows the more corn," which is inconsistent with the drill husbandry, and with setting the seeds at a great distance, which he recommends so warmly.

Mr. Hamilton in Scotland set a handful of barley at six inches distance; which, in three weeks, covered the surface and produced seven sheaves; but they being stolen, he could not be sure of the produce. (Append. p. 42.)

Miller thinks four bushels too much, it being his opinion, that we generally sow too much of all grain. If the seed could be insured against vermin and accidents, and be certain to grow, it would be no great difficulty to ascertain the quantity.

Others seem of the same opinion; and this concerns all, or most sorts of corn. The method there mentioned of sowing the furrows by hand, may probably answer well for barley.

The plowing has been spoke of before, as also rolling; the latter of which is frequently necessary; and, when rightly timed, and prudently managed, is always advantageous. It should be done upon the first shower after sowing.

Of weeding and reaping of barley.

No corn is thought to suffer so much by weeds as barley: therefore a very particular care ought to be taken to clean those out which are got into it.

This is usually done in June, and if the corn be then thin, a little pigeons dung, or malt dust, will be of great service to it.

But if the ground be duly managed, it will not be filled with weeds carried thither with improper dung, which is often the case. And if the barley follow turnips as it now generally does, the preparation made for the turnips, and the twice hoeing them will cut up every rising weed. If there should still remain any signs of this evil, the farmer may turn up the soil two or three times to the winter frosts, before there will be occasion to sow his barley. The being thus cleaned from weeds, will be very advantageous not only in the

the growing grain, but in the case of sheering or soon housing, loading, threshing, and fitting for the market.

There is a very wide difference in the manner of reaping of barley, between the practice of the north country and the south country farmers: the former generally shear and bind, and shock it clean and carefully as they do their wheat; by which means it is kept from all inconveniences.

But as this is a corn not subject to shed, and the south country farmers principal concern is, to take effectual care of their wheat; they commonly mow this; and a man will this way cut two acres a day, which is a much quicker way of dispatching it, and so far is done at a much less expence. After this, in some places, they let it lie a day or two, and then turn it: and after a day or two more, as the weather favours, and the weeds are killed, they gather it in cocks as hay, and then load it.

In other places they let it lie after it's mowed, till they apprehend it is dry enough to load, though it may be many days, and rake it both ways on heaps, turning it up a little before they load it. In those places where they meddle not with it till they are just ready to load, they are very nice in laying the ears on that part of the swash where the scythe points out, and is the highest; which they apprehend keeps it hollow, and lets the wind under it to dry it: and they are also careful in keeping the ears even together when they rake it. In some places they have forks with three large tines, two under, and one rising a good deal above it, by which they shove the barley both ways on an heap.

The Chelsea and Fulham farmers, who are thought to excel in the management of this grain, will, in a dry time, sometimes cock it in a morning, whilst the dew is on it, to give it a little sweat. A little rain on it whilst it lies in the swash, is thought rather advantageous than prejudicial to it.

Of the produce and advantages of barley.

A late writer mentions the common produce of barley to be, two and a half or three quarters of an acre; but that he has sometimes known four quarters. He speaks of what is got amongst the middling farmers, since he himself mentions much greater quantities of barley on an acre occasionally.

Four

Four quarters in the common course of husbandry, is reckoned a good crop; but that allowing for the usual trouble and expence of fallowing, dunging and repeated plowings, will not answer so well as is thought. Barley being reckoned one half the value of wheat, the whole produce would be two pounds sixteen shillings, and deducting the outgoings, that is, seed three bushels, six shillings; the usual plowings, sowing, harrowing, and rolling, twelve shillings; weeding, reaping, threshing, and cleaning, the straw being of little value, eight shillings; extraordinary dung or dressing, one pound; rent eight shillings, in the whole two pounds fourteen shillings: there is very small profit.

The common profit of beans and pease is better, and they help to improve the ground for a crop of wheat; whereas it is generally allowed, that barley impoverishes land very much, and on moderate computations a crop of oats, clover, or turnips, will be found to pay better.

This is according to the old method; but by the late improvements made by the new husbandry, a considerably greater profit arises from a barley crop, taking the produce to be the same; for the loss of a fallow year is answered by a crop of turnips, which will pay the rent and what manure is necessary, and the husbandry of them; by which method much less plowing is necessary for the barley; and by this means, all things considered, one half of the outgoings in the preparing for barley is saved, which consequently is so much clear gain to the farmer.

But there is another considerable advantage from barley, according to the new course of husbandry; which is, that of all grains, it is the best qualified to admit the sowing of a beneficial crop of clover in it. And clover being the best preparative for a good crop of wheat, at an easy expence, and wheat paying generally much the best of all grain, the promoting so excellent a crop, may reasonably be allowed an advantage.

A modern writer thinks sowing clover with barley, no good practice; and is for sowing it alone in August, thinking the sowing it with clover to be the loss of a year: but in this he is mistaken, since by sowing the clover with barley in the spring, it gains as much time as it grows from the spring till August, when it is supposed to be sowed alone, and all is in the same year.

As to the goodness of the clover, when sowed with barley,

ley, I have enquired of sensible farmers, and was answered that they had as good crops of clover when sowed with barley, as could well grow: I have seen some such myself, and particularly one this summer, at Mr. Wood's, at Brockshall near Kelvedon in Essex; which being very good, I shall here give some of the particulars relating to it.

Last year he laid down a field of twelve acres with clover, and this May 1755, he turned into it to eat it, twelve horses, eleven cows and a bull, ten oxen, eight heifers, one hundred sheep, and thirty hogs; and he kept them there till about midsummer, and then sowed it for seed.

I saw it finely grown in September, and about the end of that month, he got from it four and twenty loads of good clover. The value of all these cannot be reckoned at less than sixty pounds.

The produce of barley being frequently much larger than what is above mentioned, this may well deserve some consideration.

Miller says it is common to have ten, twelve, or more stems from one corn; and that he has counted seventy stalks of barley from one root, which had been transplanted.

In the experiments mentioned before, the three spires of barley steeped and set at two foot distance, had sixty, sixty-five, and sixty-seven, stalks apiece from their single grain and root, with every one an ear, and forty or more corns apiece in them. This great success the author thinks proceeded not so much perhaps from the grain having been steeped, as from the fertility and goodness of the soil, and their competent distance.

The same gentleman further observed, that new shoots continually struck up from the roots; so that here, if the invigorating heat of the sun had not been cooled and weakened by the approach of the winter season, there would have been continually new ripe corn, and empty ears on the same root *

This may afford matter for many curious observations.

But to consider what Miller mentions, and take his lowest estimate of ten stems to one corn, and twenty corns in a stem: this on the supposition that only one bushel of the seed barley grew, would be two hundred bushels for one, or twenty-five quarters to an acre; which is a produce not to be much expected.

* Philos. Transact, vol IV. 2d part, p. 310—311.

If such great produce be feasible, the want of it must arise either from the not having good seed, and the not ordering it well, or from the not giving it compass of ground to grow in.

The two former may be easily remedied, by common care, with a very little or no additional expence; and as to the proper preparation of the ground, that should be done in the best manner, whether you sow corn thick or thin, in the common or in the drill way; or if you set it, such good managing of the ground can be no great addition to what the farmer lays out in preparing for barley, a crown extraordinary would go a great way, either in providing any steeping, or in brining the land to any degree of fineness; or indeed in both.

This author mentions, that the barley corn which produced the most grain was transplanted; and under the head of wheat I have mentioned several advantages arising from that method.

How far such a procedure may improve the grain, may deserve the consideration of the curious: to name only the improvements made in asparagus, which is known to grow wild in the meadows in some parts of England, and there is not eatable. It hath obtained its delicate taste from the several transplantations, and different methods of management it hath met with under the gardener's care. We are sensible what changes appear in barley, when made into malt, what alterations are made in the flour of wheat by the baker, when he improves it into bread; and the changes of milk into butter and cheese, by the methods used in making them, were they not so common would be matters of surprize.

There are several instances of the great produce of barley. Platt's friend plowed twenty acres of grass ground, after cross plowed it, and harrowed it three or four times: he sowed it in the beginning of March, and had thirty quarters per acre, and sold it that year at four shillings per quarter.

Sprat barley has often produced ten or eleven quarters when sowed in March, though in other soils but three or four.

M. Nunn, in the County of Essex, had last year a large field of barley, which together produced eight quarters per acre. This is a good crop; and what land proper for barley

ley, with good management, may reasonably be thought to produce.

Of Rye.

Rye has been thought the next bread corn to wheat, and was formerly much used for that purpose, and is so still in some places; sometimes alone, but then it has a sweetness, which is disagreeable to those who are not used to it, and subjects many to cholicks; the bread is also black and heavy.

A small quantity of it was formerly, and still is in several places, mixed with wheat in making of bread, on account of its keeping moist, and then it is attended with no ill consequences. It was the more cultivated on account of its being the product of barren, gravelly, sandy land, which was then thought capable of producing nothing else, or little worth the farmer's care.

The common or winter rye requires a summer's fallow, and more expence and trouble in the management, than it is found to answer well; since the great improvements made of those dry sandy soils proper for it, by sowing of turnips, and foreign grasses, and the great profit made by them; and from the several species of corn, they give the farmer an opportunity of raising much more advantageously. This must sink it in the husbandman's esteem.

There are two sorts of rye: First, the common or winter rye. Second, the lesser or spring rye.

The first is what is usually propagated, and generally on dry barren land, where better corn will not grow.

The second is to be sown in the spring, about the same time when oats are. It is apt to run into straw if it prove a wet season, and is generally lighter than the other: however, it may be conveniently used where wheat or other autumn crops have miscarried.

Two bushels are allowed for seed to an acre, and four loads generally reckoned a middling crop: it usually carries equal price with barley, about one half of the price of wheat.

In several places they sow rye together with wheat on the same ground, and then it is called *massen*, that is, *miscellane*: it will then bear a price in proportion to the quantity of wheat.

The best judges think this ill husbandry, since as the rye is ripe before the wheat, and must stand till they are cut together,

gether, it will shed a good deal of its grain; and what is more, the grains when so mixed seldom make a bread that those can well bear, who have been used to wheat. Rye producing a spirit, is now said to be much used for that purpose, and so far may save wheat.

Rye is a quick grower, and the common sort, as well as the other, sometimes is sowed in spring, when wheat miscarries. The smaller rye is very proper for this purpose, as it is usually ripe at the common time of harvest. The common sort is sometimes sowed late, in order to be plowed in to fertilize the ground for a better species of grain.

There is a more beneficial prospect of sowing it in autumn, which is to provide food for ewes and lambs in the spring, when turnips and coleseed are gone, and before any other grasses are grown. It may be sowed for this purpose either on land prepared particularly, or on the wheat land after the corn is carried off, or on other stubbles plowed up, or where turnips have failed. It will probably answer expectation, whichever method is taken for this purpose.

It is the best proof of a man's being a good farmer, to provide food for his cattle and sheep the whole year, and to have a further view for a second provision for his ewes and lambs, in case any of the former should miscarry.

All this he may certainly generally do, if he will consider the respective times. The common natural, and the several artificial grasses, or turnips, will continue at the latter end of the year, and also when he may expect any of them to come into his assistance in the spring: and then think of and provide such other supports for them in the time. None of them are to be had in the usual course of things, but by sowing either turnips, rye, or coleseed, by the help of one or other of which he need not much fear but he may have a plentiful provision for his stock all the year round. For which purpose turnips may be made more serviceable than is at present imagined.

It is for the want of this care, to provide for sheep in winter and spring, that in many places in the north they are obliged to prevent their ewes from having lambs, till they have natural grass on the ground, to help them to milk to support them, which is often not till the end of April, and sometimes not till the beginning of May: and then they are obliged to eat their best mowing grounds sometimes to the twentieth of May, before they can turn their sheep to the commons. If a dry time succeeds, these grounds are burnt
up

up, and their expected product of hay from their best land in a great measure destroyed.

Why may not rye be sowed for the purposes above-mentioned amongst turnips, and answer the farmer's expectation? Especially as the ground on which turnips are commonly sowed, is better prepared, and of a better nature, and in better heart than the land commonly allotted for the growth of rye; especially where turnips are sowed after the drill manner.

In plentiful years rye may be given to fowl, or hogs, which delight in it, and will feed very well on it, when ground, and made into a paste: but then they should always have water, and a few beans or pease at the last, to harden their fat.

This grain is very subject to grow in the ear, if wet comes to it; and it will be soon damaged if green weeds are mixed with it: so that particular care must be taken of it in these respects; to let it have time in the field, to prevent the weeds making it too damp in the barn which will make the corn musty.

The keeping it in the chaff, on a dry floor, is proper for the preserving it sweet after it is threshed, the dry chaff imbibing any moisture which may happen. This method has been mentioned for preserving wheat, and is useful in several other grains.

Of the Oat.

The oat is generally placed next after barley, but is esteemed of much less value, and is accordingly less regarded: though, if we come coolly to consider the profit it produces, and at how little comparative expence, we shall find it equal to barley in all uses except one, and superior to it in many; and in respect of the expence and trouble attending each, and the profit they produce, it will be found preferable to barley, and perhaps to all other grain except wheat.

The oat grows in all countries, and all sorts of land; but they are mistaken, who affirm it will grow in poor land as well as rich. Indeed no land can be too rich for it, but whoever expects a good crop of it from poor land, will find himself sadly disappointed. There is one undoubted proof of its doing well in rich land, it is generally first sown when the richest fields and meadows are broke up (to take off what they call the edge of the soil) the richness of which would make wheat run too much into straw.

How oats will answer in a rich soil, I experienced many years since, on breaking up a meadow of three acres, inclined to moisture, on a gentle descent, which, with one plowing, and no farther trouble, it being a dry summer, produced stems in general between five and six foot high, and very well headed.

In the same neighbourhood black oats were sowed seventeen years successively, in an undivided field, several times manured, and brought tolerable good crops to the last.

This was lime-stone land, and lay on a descent, and I apprehended might receive some advantage from the lands above it, by the wash descending from them.

The oat is distinguished from other corn, by the grain growing in loose panicles.

There are three principal sorts of it.

1. The common, or manured white.
2. The black oats: in some parts of England more sowed than the former.
3. The naked oat: much sowed in Cornwall.

To these we may add two others, very considerable.

4. The red or brown oats; and some, I suppose, reckon these the red, and the grey, and all of them comprise the large white Poland oat, under the name of white. The seed of it being brought from Poland, gave it that name. And as it degenerates here in a few years, it is often brought fresh from thence. It is apt to shed after rain.

The white oat has the larger kernel, and turns out more meal in the grinding than the black: the meal of a bushel of the white being near three pecks from the mill, and that of the black but two: but the white oat requires richer land, and will not bear cold so well. As to every other article, but what they call the Yield, the black is equal to the white, if not superior.

The black oat does not produce equal quantity of meal, which the white does, bushel for bushel; but the meal of the black is as white as the other, and is sweeter. The black is most made into bread, and the most eaten as such, both in the northern and some of the midland counties of England, and is generally allowed to do less injury to the ground than the others. It is more generally cultivated in Scotland, than either the common, white, or the Poland oat: nor does it need any mixture of wheat to make it wholesome or palatable.

The uses of oats.

Oats being a very temperate mild grain, are fit for almost all uses and purposes any sorts of corn can be, and being hardy will grow in almost any soil, and that with the least culture of any grain whatsoever: being very prolifick it will, all things considered, be found the most profitable of any grain (except wheat) and may, in one sense, be said to be an improver of land, as it paves the way for its producing other sorts of grain.

It is known what great fatigues and labours the Scotch have gone through, when supported only by a small quantity of oatmeal, which is a manifest proof of the goodness of that grain: and it is well known that most of the northern peasants have little else to support them in their hard labours.

Oats, when malted, make a pleasant ale: and they are used in the kitchen in many particulars, in which the flour is preferred to the flour of all other grain.

It is proper for feeding all sorts of fowls, and swine; making the sweetest bacon of all food: though it is thought very adviseable to give the swine a few pease, toward the end.

The excellency of oats, as the best and most wholesome food for horses, is allowed by all; and when they have been kept till they are thoroughly dry, there is no danger of those distempers which commonly attend those fed on beans.

They are equally useful for feeding the cow or the ewe, to help them to milk, and to nourish their young; and at the same time will support the ox in his labour, or feed him fat for the slaughter. The straw is valuable for food for beasts, beyond that of all grain, and when some of the lightest oats are left in it, and only the best threshed out (which is called batting) it is very good food for beasts.

Of the soils proper for oats:

As to the soils, it has been mention'd that they will grow on all, and do very well on most, where a crop of corn can be reasonably expected; yet oats certainly do best on the best ground; for which we may appeal to common experience, when they are sown at the first breaking-up good ground, or when the ground is well manured for them.

Oats will do with the worst tilths, and in the poorest ground, and seldom have that culture they deserve: dry

ground will agree with them as well as wet. I have had good crops of them after turnips eaten on the land without any other manure, the produce being from six to eight quarters an acre.

The seed usually allowed for an acre is four bushels; but in several places they sow six where the ground is poor, or where ill custom has prevailed. The farmer ought to be careful in getting what is good, and changing it from different soils. It is seldom oats are steeped, nor do they want it as to their certain growing.

Formerly they used not to sow oats till March, but of late they commonly plow for them at the beginning of February, and sow and harrow them in from the middle of that month: they find by experience, that their crops are ripe sooner than they formerly were when sowed later. And as this is their principal, if not only grain in many places; they weed it carefully, but have not had the beneficial custom of rolling it long practised.

In reaping of oats, the north far exceeds the south farmers: they generally shear their oats as carefully, and as clean from weeds as others do their wheat; and some of them bind their sheaves as they shear them: but others more prudently leave them open all the day, by which the middle of the sheaf gets dry; and then bind them up, and set them in shocks, ten or twelve in a shock. Two called hooders, being gently drawn over the tops of the others. They will stand thus many days without damage. The usual price of shearing is about three half-pence per thrave, and the north countrymen are dextrous at this.

If the sowing be deferred till April, it should be well harrowed in: in some places the wetness of the land obliges the farmer to sow so late.

Miller mentions oats as a profitable grain, and says the usual produce is five and twenty bushels; though he has sometimes known more than thirty on an acre. This is a very poor account of the produce of this grain, since four quarters are common on very indifferent ground; six or seven is no extraordinary crop; and ten quarters are frequently had with only one plowing, without any further trouble.

I had an hundred bushels of black oats on an acre, with only once plowing, and that without any rolling or manuring whatsoever; and it is common to have forty or fifty thraves on an acre; each thrave consisting of four and twenty sheaves,

sheaves, and each thrave yielding from one bushel three pecks, to two bushels one peck: so that an hundred bushels on an acre is nothing extraordinary. An experienced farmer in Staffordshire had three hundred thraves of good black oats on five acres on dry lime-stone ground, with only common husbandry, and once plowing. This was thought a very good crop, but not such a one as to occasion any amazement, seven, eight and ten quarters being very common. To this I shall add one instance more; which, tho' nothing extraordinary to me, will appear so to those who think four quarters of oats a good crop.

This instance is, that of a crop of oats of a pretty large field of a farmer in the isle of Mersey in Essex; which the last year brought him eight quarters and an half of oats an acre through the whole field.

This crop followed one of wheat, and he managed his land after the following manner: it being a very dry time after wheat harvest, he set fire to the stubble, and burnt it off clean; after this he gave the field three tilths, and laid it on a round ridge all winter, and then sowed it with oats in the spring.

The three plowings may be thought an extraordinary expence; but where the ground is kept in a good course of tillage, and a man with two horses can plow two acres a day, the expence is not great. An acre not engaging such a team above two days at the most for three plowings; and a considerable benefit to the ensuing crop may be reasonably expected, as well as the keeping the land clean from weeds.

A popular writer says, "people sow oats for two reasons, "one because they lower the strength of new ground, and "the other to give old ground the benefit of change of "seed;" yet this person allows five quarters on an acre as a common crop, and says, he has known nine, and that "they have often ten quarters an acre, when they manure "the ground for oats;" by his own confession and reasoning, a common crop of oats far exceeds a common crop of barley. Where the land has the same manuring for oats which barley requires, it hath the crop of oats double that of barley; and, consequently, is preferable, for the bare profit they will respectively bring to the farmer, the prices of the one and the other not being usually much different.

There are three considerable advantages the oat claims, it will grow and pay very well on those lands, which will not

answer to any other grain: this advantage is allow'd the oat by all who write on this subject.

The next is, that it is certain to bring a good crop, on the first breaking up any good meadows or pasture ground; in this case it commonly produces a very good crop, without any expence but one plowing and sowing; and prepares the same ground much better than it could be any other way for a succeeding crop of wheat, which is so eagerly sought for in all the corn countries.

The third advantage of the oat is, the benefit arising from the goodness of the straw for cattle; it is sold in our north countries, from four-pence to six-pence a thrave; consequently, tolerable good crops may on a medium be valued at twenty shillings per acre: though wheat straw excels it for thatch, oats will last several years for that use.

Another advantage it certainly has over wheat and barley, that it is got with less plowing, requires not so fine a tilth, and not near so much manuring as they do. It is not subject to smut, so prejudicial to wheat, and suffers the least in a wet season of all grain, being as soon dry as any, and suffering the least when housed wet.

It gives the farmer an opportunity of varying his grain, and it seems not to dislike the following any other grain.

It allows a long time after other crops are got off the ground, for the meliorating the land by lying exposed in fallows, and to winter frosts.

Lastly, it is superior to all grain but barley in receiving the foreign grasses to be sowed with it; on which a great part of the advantage of the new husbandry particularly depends.

A late writer says: "an oat crop is the properest of all others, to sow any of the grass seeds amongst, if the ground is in heart, because the stalks of oats are apt to stand stiffer than barley, and the grass is in less danger of being spoiled."

In this case I shall not insist on its superiority to barley, but only say it is equal to it. The oat has other sufficient advantages above the barley.

A calculation of the profits of oats.

I shall take the produce of a crop of oats only at six quarters, which may be reckoned a moderate crop.

Estimating the bushel of oats at one sixth less than the value of barley, the oats will then be to be reckoned at
twenty-

twenty-pence the bushel; which being thirteen shillings and four-pence per quarter, six quarters will amount to four pounds: the straw will above answer the sheering, loading, threshing and cleaning. The other out goings will generally stand thus: seed four bushels, six and eight-pence; plowing, sowing, harrowing, and rolling, six shillings and eight-pence: rent reckoned as the barley, eight shillings. And though oats have very seldom any manure laid on the land in particular for them; yet, in this case, I will allow ten shillings and eight-pence for manure. So that the out-goings will be in the whole, all expences and trouble allowed for, one pound twelve shillings; which, deducted from four pounds, the produce of the crop of oats, there will remain two pounds eight shillings clear profit to the farmer. Whereas the clear profit of barley, all out-goings allowed for, amounted to but about eight shillings. If oats are sometimes less, so is barley frequently: and if barley sometimes exceed four quarters, oats much oftner exceed six. On the whole, the oat seems to have a clear preference to barley, as to the profit accruing to the farmer from them respectively: on an average, the oat will be found to produce twelve for one; and few other sorts of grain can pretend to do more.

In this calculation of the profit, I reckon on the white oat.

Most writers insinuate the great advantage of oats to be, that they would grow in the north, where nothing else would; and even including in that some of our very mid-land counties, as Derbyshire and Staffordshire. It may not be amiss to consider this matter, that the farmer may not be discouraged from attempting to raise good corn, fruit and vegetables, in whatever part providence has placed him.

It was long before it was known, that a cherry would grow in Italy, or a grape in France; much less either of them in Britain. Sir William Temple, was strongly of opinion, that no better wall fruit than a plumb would grow beyond Northampton.

It is not many years since, in the parish of Asheover, near Chesterfield, in the county of Derby, no wheat was got, though it is now in great plenty; and all owing to a woman married from a corn country, who persuaded her husband to try, as there was lime enough: this proving successful, encouraged others.

Going once from Cheshire to London, I saw barley cut and in the shock, between Winnington Bridge and North-

wych; and no other corn of any sort cut in all the way to London.

Mr. Hamilton, who resided ten years there, and made it his business to inform himself in husbandry, says, "They there had as good and as large carrots, cabbage, and parsnips, as ever he saw in England."

Having paved the way for a favourable hearing by these instances, this being a matter of great concern, I shall take the liberty to enlarge a little on this point.

Vegetables principally owe their excellence to the nature of the soil, the goodness of the air, a proper situation, shelter, and a kindly suitable heat: all but the last are undoubtedly to be had in all parts of the kingdom, as well as near London; and in order to set the point of warmth in a proper light, I will give the tables of the different quantities of heat, at different parts of the kingdom, calculated by those who are well versed in these affairs.

Tables of the quantity of the sun's heat at noon, when it is vertical at the summer solstice, the two equinoxes, and the sun's entrance into Taurus, and Virgo, for the several latitudes from 44° to 56° .

In these I shall mention only those we are concerned in, beginning at the Lizard point, and ending at Edinburgh.

Degrees of Latitude.	Names of Places.	Heat, June 10.	Heat, Ap. 10. and Aug. 12.	Heat, March 10, Sept. 11.
Vert.				
Sun		100	100	100
50	The Lizard	71	49	26
51		69	47	24
$51\frac{1}{2}$	London	68	46	$23\frac{1}{2}$
52		67	45	23
$52\frac{1}{2}$	Yelverton, in Northamptonshire	66	44	$22\frac{1}{2}$
53		65	43	22
$53\frac{1}{2}$	Lincoln	64	42	21
54		63	41	20
55	Newcastle	62	38	19
56	Edinburgh	60	37	18

The gentleman who made these tables justly observes, that tho' they shew the real difference of the sun's meridian heat, in different latitudes, they do not account for the greater number of hours of the sun being above the horizon, which a northern latitude has more than a southern one; which is the principal thing as to our present purpose.

Therefore he assures the reader, in general, and by one round number, that during all the summer season, betwixt the two equinoxes, there are one hundred hours of sunshine at Durham, more than there are at Plymouth.

There are several other particulars which, under this head, may be taken into consideration, in behalf of those who live northward, which may set them on the level with some of the more southern countries; besides the greater number of hours of sunshine.

As first, the very different good sorts of soil frequently found in the northern counties, which all allow to be a considerable article in this point, when compared with several soils in the south.

Another advantage is, that in several of the hilly countries, there are frequent vallies so well guarded by those hills, and of so good a soil by nature, and the produce of which is so promoted by the reflection of the sun's heat, by the position of the hills, that they are as forward as any places in the south: allowing these the same culture, they would have as early and a much sweeter produce than the ground near London, and would produce all sorts of vegetables, and most sorts of curious fruits, equal to the best in the southern countries.

I could name several places which would answer what is above-mentioned, but shall rather take notice of those more generally known.

Chatsworth, the seat of the Duke of Devonshire, though far from a kindly situation, or placed on a good soil, is managed so as to produce most things equal in goodness to those in the south.

Haddon, two miles from it, the ancient seat of the Duke of Rutland's family, is on a better (lime-stone soil) and before it was neglected, produced as good vegetables and fruit, as then were found in most parts of the kingdom. And still, though only under a common gardener's care, bears fruits, which many years were sent to Buxton or Chatsworth. Of late years Buxton, which was always thought to be placed in as barren a place, and as unkind situa-

situation as could well be imagined, and which, within my memory, used to fetch greens and vegetables twenty miles round, to furnish the guests; even this barren place is now so managed, as to produce every thing necessary and useful, and many things curious.

These instances, with what was before mentioned, shew that the northern countries are capable of producing the grains and vegetables which some would appropriate to the south.

The whole earth is reckoned naturally barren, as to the production of corn; and clayey land, which was usually esteemed the most unkind of all, by proper culture, is brought to produce the best of all grains.

A clergyman, who made this point his peculiar concern, declares, that after living in the southern parts of England, the first part of his life, on his removal to Durham, he never eat more or better fruit, even of the later kind (except grapes) than after he came into that bishoprick; and judged a degree or two will have little influence as to fruit, in comparison of the soil and situation.

On the whole it appears, the most considerable difference of heat and warmth, for ripening fruit, corn, or other vegetables, arises principally from the nature and circumstances of soils and situations, from a place lying on the south or north side of a hill, from its being on the top of a cold hill or in a vale; from its being sheltered or not sheltered from winds; from its lying on a cold clay, or in a warm sand or gravel.

It is plain that a garden, or land lying on an easy slope on the south side of an hill, receives more of the sun's rays than the same quantity of ground lying on a plain, and hath more real advantage of heat from the sun, than several degrees of southern latitude would give it: and the argument is stronger, if the ground in the south slope to the north; the same thing is to be said with respect to cold clays, and warm gravels, they being guarded or not guarded from winds, and so on.

As to the inconveniencies common to the whole island, as the inequalities of our seasons, violence of winds, and sudden changes of our weather, they cannot be said to be more prejudicial to the north than the south: on the contrary, according to Dr. Derham's history of our great frost, the south suffered then much more than the north.

These observations may not only reconcile the farmer to

a northern situation, but encourage him to equal industry, with those who are situated more south.

Hence also they may draw useful observations, as to the ordering their grain and their roots, from the advantages they may reap from the different soils, the position of their grounds, as to the north and south shelter: it being commonly observed, that one side of a corn land, in many situations, is thinner than the other.

Of keeping of oats.

The oat may be kept secure in the easiest manner. It is little subject to receive damage in the barn or stack, on account of the nature of the straw, which is sweet and dry, and the least subject to be musty of any.

Oats will also keep very well when threshed, and laid by in the chaff, without further trouble, provided they be not laid by wet, or wet permitted to come to them, in such a degree as would spoil any other corn.

The principal method of securing the product of this grain, where it is used as bread, is by first grinding it into meal, and then putting it close down in a chest of wood. This is so well known in the countries where the meal is used for bread, that there is scarce a family but has one of these chests, or arks, kept under lock and key, either in the dwelling house, or some building adjoining to it, or in their barns. Those who are able to keep it for a rising market, sell it at the same proportionable profit, as those do who can save wheat till it rises.

Of the Bean.

The bean was much esteemed by the ancients; but it is disputed, whether their bean was the same which is now usually sowed: since it is certain from Theophrastus and Dioscorides, that the bean of the ancients was small and round.

It seems incredible, that a pulse so common, and of such daily use, should change its name, and have another substituted in its place.

If a conjecture may be allowed, the bean of the ancients, as describ'd by Mr. Ray, to be small and round, and which was formerly so much eaten, seems more like what is now called the magazan bean, than that we commonly sow.

The beans now in use are principally two; the less or horse

horse beans, sowed in the fields. And the great garden beans.

Pythagoras forbid his disciples meddling with beans; he meant that they should abstain from meddling with affairs of the republic; because the ancients used beans in electing their magistrates as balls when they voted.

The bean has a papilionaceous flower, which is followed by a long pod, filled with large seeds: the stalks are firm and hollow, and the leaves grow by pairs, and are fastened to a middle rib.

Farmers seldom sow any but the horse beans in open fields: but many of those called garden beans are now much cultivated in the fields near London, and in other places, and are equally capable of being managed after that manner, with greater advantage to the owner. A garden is but a little field, well cultivated; and what we call a field, a great garden capable of all the same methods of management. The large field managed with the same proportionable industry, manure, and care, will produce a proportionable profit, in the case of beans, and also all sorts of vegetables, as will evidently appear to any person who will but walk into the fields about Chelsea, Fulham, Battersea, and so on.

The principal varieties are these.

1. The common field bean.
2. The early Lisbon, or Portugal bean; commonly sowed by gardeners, one of the earliest ripe, and principally valuable on that account: it is often sown in October or November, and does not require so much sun, as a proper shelter by hedges.

Derham observes, "that snow preserves bodies thirty years uncorrupted, and guards the corn against cold piercing winds,* and in his history of the great frost,† he observed, "that many small fields of wheat escaped pretty well, where fenced with thick high hedges against the cold winds; especially where they were covered long with snow. Those suffered more where the winds blew off the snow; and those where the best wheat which were on such pieces as lay on gentle descents, facing the west or south west, especially when guarded on the east side with a hill, or a wood, which fenced off the cold piercing easterly, and north easterly winds."

* Physico Theol. page 34.

† Philos. Transact. Vol. IV. page 122.

Several other curious persons confirm the same, and observe, "that easterly winds do more mischief sometimes in spring after a few favourable days, than all the winter frosts, since by sudden changes of the weather, the passages in trees and plants are stopped; the crude sap setting becomes a disease in trees equal to that of chilblains in juvenile blood, which sometimes takes whole trees, and sometimes branches only."

This being a matter of consequence, and applicable to many cases, I thought it might properly be inserted here: both for the sake of the farmer in the field, and every private person in their respective gardens.

It was common to plant early beans, and things of that kind under walls, that they might have the benefit of the sun: but experience instructs us, that those situations are frequently fatal, and therefore most now rather chuse to set them against hedges, or reed hedges are run along the garden for that purpose, yet with the greatest care, and the desired success, they will only be found about a week or ten days earlier than those set in the spring.

The small Spanish bean comes in quickly after the Lisbon, and is a sweeter, and will consequently be preferred to the other.

The broad Spanish bean is a good bearer, and comes in before the common sorts.

The Sandwich bean succeeds soon after the Spanish, and is almost as big as the Windsor, and is a plentiful bearer, and a hardy bean; and consequently may be sown much sooner by a month.

The toker bean is a great bearer, and comes in about the same time with the Windsor.

The blossom beans, which are black and white, are very green when boiled, and very sweet; but the seed is subject to degenerate.

The Windsor bean is the best of all; and when it has room, and a good soil, is a plentiful bearer, and very large.

These are seldom planted till Christmas, because they bear not the frosts, so they generally come in June and July.

The magazan bean is esteemed the first and best sort of early beans now known. The seeds are smaller than those of the horse bean.

If these are sown in October under a warm hedge, pale, and

and so on, and earthed up as they rise, they will be ready in May, and bear plentifully.

These seeds were brought from the coasts of Africa by the Portuguese, and from them to us. When the seed is sowed here they grow larger, but ripen not so soon.

These several sorts differ in shape, and require different times of setting: they vary in their qualities of bearing the hard weather better or worse. Notwithstanding all which, they are only seminal variations: for which reason great care ought to be taken of procuring proper seeds.

Beans when about two inches high, should be carefully earthed up, and so as they rise two or three times; and, in very severe weather, should be cover'd with pease haulm, to be taken off in mild seasons.

These planting of beans may be repeated once in three weeks, and the less care is necessary as they come later, and the less seed. The setting them at greater distance will do as they are set later. The Windsor beans may be set in rows at a yard distance, and at three inches in the rows.

The after crops should be planted about a fortnight after each other, from February to the middle of May, kept clear from weeds; and when they are in blossom cut off the tops of all. The later the beans are sown, the moister ground they require.

Of the seed, sowing, and peeping.

Care must be taken in the choice of seeds, particularly when brought from distant places; or when had from strangers; since the crop must miscarry if the seed be bad; and where it is but indifferent, the greater quantity must be used to answer for accidents.

There are four ways of sowing, or planting beans.

The old way in the field was generally to plow the ground, and let it lie some time: then to sow them in the broad castway, and harrow them in. This was seldom found to answer well; the seed being too much exposed to be eaten by birds, or burnt up in summer, for want of a proper depth.

Of late they generally sowed beans under furrows, plowing them in with as thin a cast as possible; and, in very stiff lands, they harrow the ground after a shower, when the beans begin to peep, which helps to break the clods, and let out the tops. Care should be taken not to plow too deep, for fear of burying the seed, and to lay the turf flat, not edge-ways, that the beams may be covered with

with mould ; since if they lie hollow, they will be subject to decay.

The second way is by the drill plow ; but a stiff soil, and the make of the beam does not suit it well.

The third method is setting the beans by hand, in rows, at three inches distance, when the ground is properly prepared : which the women will do in many places for three-pence the peck. This is a moderate expence ; and will be saved in the seed beans used this way. But in this way I should prefer the making the holes with a trowel, rather than a dibber ; which, though it gives a little more trouble, it prevents the beans from lying hollow ; and leaves the mould looser about them. It comes nearest the sowing in drills made by the hand hoe, or by the common plow ; which may be reckoned the fourth and last way : both these are used by gardeners ; who are expert at the hand hoe, and will dispatch a great deal in a short time, and plant the rows at any desired distances, either to have the interstices left open for other crops to grow betwixt them, or for the beans to spread.

This method of planting the beans, seems to have every advantage that can be obtained, both in respect of the depth and distance ; and also in regard to their being inclosed by mellow soil, into which they may freely strike every way.

The common plow may answer most of the ends last mentioned, and is much used for those purposes ; and, I presume, the method of sowing by the hand along with the plow, may be equally useful in beans. Gardeners are said to love the plow in this, as well as some other cases.

Steeping of beans is not common for those sowed in the field, the season being usually wet, and consequently there being no occasion for it, on account of their being made to vegetate ; but the bean will bear steeping very well, and those planted in gardens late, frequently are steeped with very good success.

I have frequently steeped Windsor beans in milk, in milk and water, in the water coming from a dunghil ; and in water in which sheeps dung was dissolved, and in these several liquids, varied different ways ; steeping from twelve, four and twenty hours, and longer, and I found they answered very well, I do not remember that any of them miscarried, and these are things easy to be met with, and what may be usefully applied in almost any quantity.

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The

The usual quantity of seed for an acre is about three bushels in the common way, which is now found more than necessary; since experience shews, that when they have more room, they bear better. They should never be set in rows less than a foot distant; and if wider the better, and not closer in the rows than three inches. The farmer may proportion his distances accordingly in any manner of the planting them; as when the ground is plowed for them, by missing one or two furrows; for their being any way in rows gives him an opportunity of hoeing and earthing them up: sowing any compost amongst them, letting sheep into them before they blossom, to top them if they run too much into straw, or are infested with the pernicious dolphin fly, so frequently fatal to them, especially when they grow close, and in small inclosures. Against this the topping the beans is very useful. Gardeners do this with sheers, and they may be topped to about two foot high, or to three in the field, in the same manner, with no great pains, or with a short scythe fixed in a proper stick with less labour.

The farmer must frequently change his seed; and not sow beans in the same ground soon. The best method of changing is, by bringing seed from stiff land to that which is lighter, and from the lighter to the stiffer.

Of the soil; and preparing the ground for beans.

A strong moist soil suits the bean best, and it prospers better open than when confined in small inclosures; where it is more subject to blight, and the fly: warm light land is by no means proper for beans.

Vales generally do best, the chiltern or up-lands being frequently too light and dry; especially if a dry season follow, or the ground be plowed oftener than necessary; by which it will be left hollow.

As to preparing the ground for beans, there are two things to be considered: when it is only just broke up for them; and when, according to the course of tillage, it is to be sowed with them.

In the first case the ground is supposed to be in a proper condition for a good crop, and then such a produce is expected. Also, that it should be useful in making the land mellow for an after-crop of corn; and to keep down the weeds. We are told by a modern writer, that these ends, and much the greatest produce will be obtained, if the drill
and

and horse plow be used to stir the ground betwixt the rows of beans.

How far the horse plow will answer as to weeds, has been shewn before. But the strong objection against it in this case is, that it turns the weeds towards the beans, and that it is then more trouble to get them out there, than the hoeing the whole with the hand hoe. I know an excellent farmer who chose last year to lay out fifteen shillings an acre in hoeing his beans by the hand hoe, as the best way: not that he expected his beans to pay him, but in order to prepare his ground clean for a crop of wheat to follow. Beans being known not to impoverish the ground, but rather to improve it for wheat. This farmer was right where ground is fresh, and some prepared compost on it since broke up. The land is commonly plowed early in autumn, and they let it lie in ridges till Christmas, by which it has the benefit of winter frosts and weather: after that it is then plowed in smaller furrows. Two plowings will make the ground fine enough till it is plowed and sowed, when the furrows should be made shallow.

If any improvement is proper during the time of their growth, a compost may be spread amongst them, and will presently incorporate with the soil, on the loosening it either by the horse plow or hand hoe.

Sir Hugh Plat mentions the scattering two bushels of salt amongst the beans, at several times, and why may not sea sand be thrown amongst them, or some sea water conveyed amongst them; these are known to fertilize ground, and destroy weeds and vermin. In Cheshire I have known brine poured on pavements to destroy weeds; and I ordered a cart load of the sweepings of a salt work to be spread on a parcel of rough ground, and it being laid thick on about two hundred square yards, destroyed every vegetable on it, but would enrich the ground for the future, and it would, by degrees, become fruitful. Small trials are easily made.

Common salt weighs about fourteen pounds to a peck, the fourth part of a bushel.

Of the produce and advantages of beans.

A reverend author reckons the common produce of beans to be twenty bushels the acre, which allowing three for the seed is about seven for one; and adds, "that no grain yields a greater increase than this, if it is rightly cultivated, nor turns to greater profit." (p. 103.) He mentions one

single horse bean producing ninety pods, containing two hundred and thirty-two beans, which the next year produced three gallons; the next year seven bushels and a half; in fine, seventeen quarters and two bushels in four years from one bean: but this does not equal the produce of corn.

A very ingenious writer mentions thirty bushels as a produce of beans not uncommon from good vale lands, per acre, and there may be an increase of ten bushels by the modern husbandry.

Taking the produce at thirty bushels as a medium, and deducting the seed, there will be twenty-seven bushels clear, which, at two shillings per bushel, will amount to two pounds fourteen shillings.

Out of which deducting rent eight shillings.

Three plowings, twelve shillings.

Harrowing, hoeing, and weeding, eight shillings.

Reaping, loading, and threshing, six shillings, the whole outgoings are one pound twelve shillings; which being deducted from two pounds fourteen shillings, the produce is one pound two shillings.

What is this, compared with the profit of a middling crop of wheat or oats.

We should not do justice to this species, should we omit any advantages it is usually attended with.

Besides the profit, it gives the farmer an opportunity of changing his grain, and so far occasioning the production of better crops of wheat, barley, oats, and clover, in their successive turns: it being undoubtedly true, that the longer any grain is deferred before it is sowed again on the same ground, the better the crop may reasonably be expected.

Another advantage of beans is, that they give an opportunity of planting other roots betwixt the rows, which will not hinder the growth of the beans, and may bring in a considerable profit. Whoever looks into a good gardener's ground, will soon see such varieties of this kind, as to give him sufficient choice of this sort. And great variety of vegetables, as carrots, turnips, lettuce, and many more of the same nature, may be sowed or set in the interstices.

Pease have frequently been sown, and are thought to do tolerably with beans, and it is said may be advantageously supported by the beans; but wherever they clasp the beans, there can be no expectation of any pods as far as the pea reaches. Pease may be sowed betwixt them, when the beans are set in rows two foot asunder.

Turnips

Turnips sowed betwixt the beans would answer well, both as a crop and for keeping down weeds.

When the ground is hoed, the turnips might be sowed with very little trouble; there would want nothing but a raking, to cover them a little.

If some turnips were transplanted, and set at a foot distance betwixt the rows, they would do well.

The drill method of sowing is thought not to suit beans very well, on account of their shape, which is an obstacle to their falling regularly in the rows, and they requiring a stiff land: this method of husbandry does not well suit that sort of ground.

Of reaping beans.

Beans are reaped with hooks as pease are, or shorn: in both ways they are bound up in sheaves, and set on an end together.

They are commonly bound with straw bands, but the better farmers buy a coarse sort of hemp twine, and cutting it into proper lengths, bind up with them; by allowing three inches more than necessary the first year, for the loss of cutting them open when laid on the floor for threshing, these bands will serve two years very well.

Beans are frequently malted, and mixed with other malt for brewing of ale.

Of keeping beans.

Beans will keep in sacks for a considerable time, or in a stack in their straw: and some keep them in hair bags, to secure them against vermin.

There is a custom in Essex, of putting four bushels in a sack. But to facilitate the removal of large sacks of those, or corn in their granaries, and other places, they have a machine.

A machine to wheel sacks in granaries, corn chambers, &c.

It goes on two wooden wheels, the diameter of which is five inches, pegged on the outside through the end of the axletree, which is eighteen inches long, and where square an inch and an half, and is fastened in the stils, which are there a foot asunder, and the other is round for the wheels to run on.

The stils are like those of a common plow, three foot six inches long, and kept asunder and firm by a flat let thorough

them at two foot high, where the stilts are fourteen inches wide betwixt them, and two inches and an half on the side, and an inch and an half front : they grow narrower in the substance, but wider betwixt them to about seven inches, and then are rounded and bend backward to handle them by.

At the bottom a board four inches and an half broad, and an inch and half thick, is let a little into the axle tree and stilts, and sloped downward : the under out edge of this is taken a little off, so that it falls near level with the bottom of the wheels, and the machine stands upright when set on the level, but is bent backward by the handle when the sack is on it, and the sack will rest on it as it stands.

An iron plate an inch and an half broad, is nailed six inches on the bottom of each stilt, and along the axle-tree, and two inches over the bottom board, to strengthen it.

Cross the outside of the bottom board a rib is nailed, an inch and an half at each end : it goes even so far, but the middle rises gradually each way to a thin edge, which, on bending the stilts forward, goes under the bottom of the bag, and when the top is pulled on it to the stilts, and this keeps the sack from slipping off.

The substance of the weight rests on the wheels, and is easily turned any way by the stilts or hands.

Most people know the weight a person may draw or wheel with ease, in comparison of what they can carry ; and the common waggoners draw three ton with five horses, when twelve hundred would be a sufficient load for them.

And why may not a board be fixed to it at the cross bar, and be opened when wanted, and set on the foot board by an iron, to drop down and hold it, as is often done in seats : on this almost any thing might be carried from place to place, or the wheel might be made deeper, if necessary, or a pair of larger wheels occasionally be put on the same axle-tree.

Of Pease.

The pea appears under so many forms, there is need to explain them ; distinguishing which belong to the farmer, and which to the garden. About great towns, particularly London, the farmer sows some kinds of the garden pea, and the gardener makes his plantation in the fields, so that they intrench upon one anothers province. There are therefore some kinds of pease common between them ; others peculiar to the farmer ; and another class, that the gardener is alone concerned withal.

The

The pea is a climbing plant, with slender branches, and numerous leaves, with clasps or tendrills, by means of which it lays hold of what stands near. The flowers are papilionaceous, and are succeeded by pods, in which are contained the peas.

The flower of the pea stands in a little green cup, form'd of one leaf, divided into five parts.

It is composed of four leaves, one upright and broad, two stand side ways, and are short and roundish; the fourth stands at the bottom, and is short and compressed.

Within this flower stand ten filaments, nine are short, and grow together; and one is longer, and stands separate.

Among them rises the rudiment of the pod: this is small and flatted; and there rises from it a membraneous thread, to the side of which near the top, grows a little head pierc'd for the reception of the dust, from the round heads of the filaments.

This dust impregnates the seeds, and when the flower is fallen they swell, and the rudiment forms the pod. There are four species, which, from their general form and manner of growing, are plainly distinct kinds, owing to nature, not to art.

1. The garden pea, which may be called the white pea.
2. The field pea.
3. The sea pea.
4. The simple leaved pea.

The garden pea has winged leaves, and several flowers upon one foot-stalk. The field pea has but one flower upon each foot-stalk. The sea pea has an angular stem, and several flowers upon each foot stalk. And the fourth has simple or single leaves.

Winged leaves are composed of several pairs of others. The first of these is the pea we cultivate in gardens, the second is that sown in fields: and under each of these really distinct species, there are many lesser varieties: the sea pea is wild in England, it grows on the sea coasts, in barren naked clifts of rocks, and among pebbles, where no earth is seen to give it nourishment. The fourth is a native of the Greek islands.

In a time of great scarcity, the people about our coast found the sea pea in great plenty, and fed upon it. Till necessity had sent them to its stores, they never had observed it, and they then thought it sent by miracle to their relief.

The reason of its thriving where no earth appears is, that

it sends the roots to a great depth. The produce of it is very great in its wild state, as appears by the numbers who were in that calamitous time supported by it; and there are reasons enough to try how it would answer by culture.

There are many acres of waste sea beach, on which nothing useful grows; it would be worth while to try this native pea upon them.

We see it will serve for food to ourselves, but if only for cattle, it would still be worth raising.

Of garden pease.

Gardeners raise a variety of auriculas, tulips, and carnations from a few original kinds, and so it is in the pease. Good ground, and careful management, go a great way; and the mixture of the dust from the buttons in one species with that of another, or to impregnate the seed does the rest.

If we were writing to the gardener, we should enter at large upon this head: but as the husbandman has less concern with it, we shall treat it more lightly; not omitting it, as he may in particular situations find it profitable to fall into the practice. The three most distinct varieties, are, first, the great or rouncival pea; secondly, the square pea; and thirdly, the umbellated pea; the gardeners enter into a longer detail. Their principal kinds are,

1. The early pea, called the hotspur.
2. The dwarf pea, a low kind, the stalk much firmer than the common one.
3. The french dwarf; less sturdy than ours, but the pea is more delicate.
4. The soft shelled pea; this has a husk so tender and sweet, that it is eaten in the manner of the french bean.
5. The large pea, called the maple rouncival. This has a beautiful red flower, and the pea, when ripe, is variegated with several colours. It is sometimes sown in fields.
6. The crown pea, the umbellated pea before named, but the gardeners raise a smaller kind than that described by authors.
7. The spanish marotto, of the rouncival kind, very large, and distinguished in the dry seed by a black line.
8. The marrowfat is distinguished by the breadth of the pod, and the softness and sweetness of the pea.
9. The union. This is one of the rouncivals, well tasted, but very large.

10. The

10. The flat rouncival is a great rarity in some of our curious gardens; a middle pea between the rouncival and marrowfat.

These are the most distinct kinds. The four principal he should meddle with, if with any, are the common white, the hotspur, the rouncival, and the marrowfat.

Of the culture of the garden pease.

Early pease are raised about London, by the assistance of walls and hot beds. They are to be sown under a warm wall, in October. The earth is to be drawn up about the plants as they rise, for by this means they will be secured against the frosts; and having been kept alive till the beginning of February, they are to be removed to hot beds, where they must be planted at two inches distance, in rows a foot asunder.

The french dwarf is a good kind for this. The next are the hotspurs.

This must be sown in a rich soil, and warm spot, in the end of October; that called the master's hotspur, is the earliest and best.

As these rise in height, the earth must be drawn up about their stems; and if frosts are severe, some old pea stalks must be thrown over them.

In spring they must be weeded, and kept clear of slugs. A little lime will destroy them. Thus managed, the pease will bring an early, and large crop. The spanish marotto is to be sown in February; and in the beginning of March the common rouncival.

Keep them clear from weeds, and be cautious not to tear the stem in gathering.

According to their size they must be sown at different distances: the largest pease the farther asunder.

Of field pease.

The field pea is divided into many kinds.

1. The white pea. This comes the nearest to the common pea of the garden; and its principal difference is, that it is smaller.

2. The grey pea. This is a large and very useful kind.

3. The blue field pea, called in many places the hog and pig pea.

There are as many varieties of each of these as of the garden kind, and named from places where they have been raised, and other trivial accidents; but we shall cut off a great

deal of perplexity, by telling him, all that vast variety are to be reduced to these three principal kinds; and that these being very distinct in themselves, and strongly marked by their different colour, he will find it easy to distinguish them severally from each other, and know to which of these he is to refer any of the rest.

The white, the grey, and blue pea, are distinct, and require a separate management; but that which is proper for one white pea is proper for all white ones, and so of the others.

The white requires one kind of soil, the grey another, and the blue succeeds best in a third; but all white pease require the same soil with the common white; all greys the same with the common grey; and all blue the same with the common blue.

Of the proper soils for the three kinds of field pease.

Pease are a very useful crop on many occasions: when the farmer is about to raise them, let him examine the nature of his land, and suit the kind to it.

The white pea being of the nature of the garden kind, succeeds best upon that land which is most like garden ground: let this kind be sown in a field, the soil of which is fine and rich. A deep mellow earth, or a rich loam that is not too sandy, are the two kinds that suit best with this species.

The grey pea is hardy, and loves moisture; for this reason a clayey soil suits best with it.

The blue pea is hardy like the grey, but nothing hurts it more than cold and wet, therefore its proper soil is the light, sandy and dry.

All white pease love a mellow earth; all grey pease, a clayey; and all blue pease a sandy: and as there are certain soils that suit them, so there are also distinct kinds of manures, which best agree with them.

Dung is the manure that best agrees with the white pea; nothing enriches the ground for the blue pea like lime. As we have mentioned a clayey soil for the grey pea, some may be surprized at our naming marle as the manure in which it most delights; but we have shewn that the proverbial saying against marling of clay, is not so universal as has been imagined.

Any soil in which there is clay, will support the grey pea profitably; and marle will enrich it excellently for this purpose,

purpose, at the same time that the pea itself improves it for corn.

This is an article of great consideration. The pea not only yields a good crop in itself, but serves the husbandman in destroying weeds; it improves the land on which it has grown, and excellently prepares it for other crops.

This article of the particular soil suited to each kind of pea, has not been hitherto sufficiently considered; and the farmer therefore is not acquainted with the great advantage of this pulse.

He finds it serve in the succession of his various crops; and when chance directs him to sow the right pea upon the right soil, he sees the advantage in its full light. These are called favourable years, and the expectation of them keeps up his spirits; but what he attributes to some unknown cause, may be the effect of his own care and application; and what he thus finds from chance now and then, he may at all times command from proper management.

The grey pea will yield its full produce in those stiff soils, which so well agree with its nature, without the frequent fallowings; serving in the place of a fallow, while it is yielding all the time so profitable a crop: and so it is in each of the others, only observing this proper management.

In respect of manures, pease will always answer to the expence of them; and the profit is not to be expected wholly from these, for they exhaust the land so little, it is not the less fit for a succeeding crop.

Pease ripen earlier in land that is less manured; but the richer it is made, the greater is their produce.

Wheat, the richest and most profitable of all grain, follows pease excellently; and the season of sowing the wheat comes so naturally after that of gathering the pease, that it seems as if they were designed to come after one another.

As soon as the pease are cut, the land should be plowed across; after this it should be harrowed, and then plowing it again in the beginning of October the wheat is to be sown.

Of the sowing of pease.

Two articles are to be considered under this head; the quantity of seed pease proportioned to the ground, and the manner of placing them in it.

The larger the sort of pea, the greater should be the distance of the plants. And upon this depends the first article of their management.

Good

Good ground will enlarge a poor pea, and a starving soil will reduce one that is naturally large; but we can here speak with sufficient certainty, knowing what is the condition of the three sorts into which we have divided field pease in ground equally favourable.

The grey pea is naturally the largest plant, the white the next in size, and the blue the least.

A good soil may enlarge the smaller kinds, perhaps so as to equal these naturally larger, on a poor one; but there is also a difference in the size of the plants among those different varieties we have named, of these several general species. All this is to be considered as the occasion of accidental variations; but, in general, the rule is what we have here laid down; and, consequently, the greatest number of pease is to be allowed to the acre in the blue, and the least in the grey kinds; the white being kept as a medium.

We say number in this place, because the measures may deceive: the grey pea being larger, consequently fewer fill the bushel. This makes a certain difference, but not so much as is necessary in the management of the plants as to distance in the field. The farmers know this, and proportion their measures accordingly; but though they are right in the thing itself, they fail in the degree, for they allow too large a proportion of the great kind.

The allowance in the common way of husbandry, in those counties where the culture of pease is best understood, is two bushels of the grey to an acre: they allow three bushels to an acre in the white pease, and four in the blue. But all this is too large: nothing succeeds so ill in a promiscuous and irregular sowing as the pea; and when they are planted regularly, there may be an absolute certainty as to the quantity and distance. The time of sowing pease differs also according to the kinds; though this rather respects the soil to which they are suited, than any thing in the pea itself.

The grey pea is to be sown in February, because growing in a cold stiff soil, it makes at first but a poor progress. The time for the white pea is the beginning of April; and the blue may be sown a fortnight later than this: the middle of April is the best general time.

The husbandman who recollects what we have said on the nature of soils, will easily conceive what we mean by this: sandy soils make a quick shoot in what is sown upon them, and therefore this late time is very proper, for they have

have still enough of the season for their growth. The white pea has a soil of a middle nature between these, and therefore it is to be sown at a middle time.

We now come to the manner of sowing them.

The white pea is usually sown with a broadcast, and harrowed in. This is that promiscuous and uncertain method we have before mentioned, as so improper for pease of any kind.

The usual method is to sow the grey pea under a furrow; and this is so hardy a kind, that it may be put into the ground any time during the latter part of the winter.

The blue pea is sown as the white, only thicker, and is harrowed in after the same manner.

This is the way in many places, but it is the worst of all. The first improvement for the planting of pease was the Suffolk Dibble, so call'd from its place of invention or original use. This is a kind of iron rake with the tines set parallel to the handle. The handle is of the same form as in the garden rake, the cross piece is thicker, and there are four, five, or six large iron spikes let through it. The way of using it is this, a man goes over the field with the dibble, and women follow him with pease in their aprons. He strikes it into the ground, pressing down the tines with his foot upon the back of the cross piece. Thus four, five, or more holes are made, into which the women drop their pease, one into each, and leave them open. This done, the whole field is lightly harrowed over, and all are covered together.

The person who strikes the dibble, generally goes over the field backward and forward in rows, or lines, a foot asunder, but 'tis done at random, and the pease grow in a slovenly and irregular manner.

This method is expeditious, and disposes the pease with a degree of regularity; it is therefore preferable to the random method of sowing them by hand; but it is capable of easy, and great improvement.

The farmer who intends to set his pease by the dibble, should have three kinds of instruments made according to the difference of his pease, and the distance they require in growing; one for grey pease with the tines five inches distance, another for white with them at four, and another for blue at three inches. The tines should be longer for the grey than for the others, and shortest of all for the blue; because experience shews, that the seed of the grey will bear deeper covering in the ground; and this is an essential article;

article; the seeds of no crop whatsoever being more in danger from mice, birds, and vermin.

When the farmer has provided himself with proper instruments, I would have him order the dibbler to go over the ground with regularity, drawing a gardener's line across, and working close to it. This would set the rows exactly strait, and would make the work easier and less hazardous to the hoers.

The rows might thus be easily planted at an exactly proper distance, and that proportion'd to the kind in each. The grey pea rows should be two foot asunder; the white a foot and half, and the blue little more than a foot.

Thus would the field be planted with regularity, and the hoeing and reaping would be done the more easily. There would be a little more expence, but very little in the first operation; but this would be saved in the two others.

We have named here what may be called a middle distance for the several species: a finer or coarser soil, a richer or poorer ground make some difference in what is to be done in this respect. The farmer having here the medium, will easily make the proper variations.

In some places they follow the garden practice in the field, opening trenches by line, and covering the pease, when in the ground, with hoes. This is better than the method by the dibble, in that it leaves the earth more loose all about them; but it is more expensive, and the other succeeds very well.

Having named what are the several manners of sowing or setting of pease in the practice of the common husbandry, it is time to speak of what may be done in this article by the drill plow, and the horse hoe, its happy and proper attendant.

We have shewn how other crops are capable of being improved by this practice, but there is none that can be so greatly assisted by it as the pea of every kind; nor any to which it is so happily suited.

We have shewn the advantage there is in setting the pease in rows by the dibble, and mentioned wherein the garden method of the trench and hoe is superior to this; but the drill plow answers both purposes together; it does better than either, and the expence is less.

We advise the farmer to use this method preferably to any other, and shall give him all the needful directions in a few words. Having explained at large the general method

of

of drilling, and the structure of its instruments, little is needful to be said in suiting it to the particular circumstances of any crop.

Let him see his instrument be properly made; and let him go over the field sowing his pease in double rows, with one foot partitions, and with four foot interval between every two pair of rows.

The pease will thus be let in regularly: the earth will lie loose about them, they will shoot freely, and they will be disposed in the most happy manner for weeding and reaping.

Of weeding the pea field.

When pease are sown in the random way, hoers are to be sent into the field when the crop is up, not only to cut up the weeds, but to thin the pease where they stand too thick, which they always do in some places.

Pease are round and smooth, therefore they will roll about easier than any other seed. We have shewn how apt corn is, when sown in the common way, to run in heaps in the holes, and leave other parts of the field destitute; but this is much more the case in the pease, because of their figure; and hence it is that of all seeds sown promiscuously they are the most apt to rise in clusters. Hoeing them thinner is the more needful, because in no case the plants more hurt one another.

The farmer must be careful in his instructions; and keep his eye now and then upon the people, otherwise he will have a poor crop.

When the pease are set by the dibble, made according to our directions, the hoer's business is reduced to the one point of cutting up the weeds: and it is easily done, because he is to work in regular spaces.

In the other way, by the trench hoe there will be the same advantage of a clear space to work in; but as the seeds have been there scattered a little at random, the hoers must be ordered also to thin them in the rows where they meet with places, in which they stand too thick.

These are the methods in the common ways of planting, and the advantage of the hoeing is not confined to the present crop; for destroying the weeds, it prepares the land for that which is to follow.

In the method we have proposed of sowing by the drill, the horse hoe, as well as the hand hoe, is to be employed;

ployed; and the effect of this upon the present crop is prodigious, while at the same time it acts as a thorough fallowing of the land for that which is to come afterwards.

We have shewn to what a depth the root of the sea pea will penetrate the earth for nourishment: all pease are enclined to the same particularity; and as few plants with fibrous roots penetrate deeper, none whatever spreads farther under the surface at the same time.

This may shew as the reason, that there is no crop which receives such great, palpable and evident advantages from horsehoeing.

We see how deep the earth may be mowed advantageously for pease, and there is no way of doing this but by that excellent implement the hoe plow: as the advantage, in this respect, is much less from handhoeing, which only breaks the surface, so it is in respect of the improving the ground for future crops.

When the drill plow has been employed in setting the pease in double rows, and with the large intervals we have directed, the horse hoe must come in to clear those intervals, nourish the crop, and fallow the ground; while at the same time the hand hoe is necessary among the plants. This need be used but once, the other must be repeated occasionally, and the manner of using both is this.

When the pease are four inches high, the hand hoers are to be sent in, but as they have only a very small part of the ground to work upon, a few of them will do for a large field; and a little time will be sufficient.

The pease will stand according to this method of sowing in double rows, with a small space between row and row, and a great interval between one pair of rows and another: and the whole ground between and about them, will be well covered with a young crop of weeds.

The partitions between one row and another, in each pair, are the part where the hand hoers are to be employed; the larger intervals are to be left for the horse hoe.

In handhoeing these spaces must be cleared of weeds, and that being once done, is not to be repeated: for the young crop being thus got down, will never be succeeded by another in that place. The rows at this time appear distinct; and there is room for the growth of weeds between; but soon after the pease grow to a height, and meet one another, so that no weed can grow among them.

The handhoeing being over, the ground is to be left to
itself

itself some time. The moving and breaking the mould just about the roots of the young crop, on one side, will do them great service, as they now are young, and spread principally at a very little depth: afterwards they will require a supply at their greater depth, and that will be given them by the horse hoe, though it could not by any other means whatever. This is what they extremely want, and this is the reason of that vast fertility which will follow the use of that instrument.

When the weeds are grown to some height, the horse hoe is to be sent into the field: it must be carried strait up in the midst of every interval; and it must be set to cut deep.

This will tear up great part of the weeds, and bury the rest, and will not shake the plants.

The farmer may now send in his hand hoers again, to cut up the weeds close on the outside of every row.

This is not altogether necessary, but it is useful; and will very well pay the little charge it costs.

While this second handhoeing breaks off the ends of the short and slight roots within its reach, the deep furrow in the centre of the interval cuts off the ends of all those longer and more serviceable ones which had penetrated so far, and spread so wide, as some at this period of the pease's growth will always have done; and from the broken ends of these there will be innumerable others immediately formed, ready to draw nourishment; and they will have a fresh broken earth easily to spread in, and full of that nourishment for them.

As to the repetition of this horsehoeing, the farmer may be left to his discretion. If he do no more he will be sure of a great crop, for this new broken ground will supply the roots with a great quantity of nourishment all the time the pease are to be upon the ground: but if he chuse to repeat it twice more, the advantage will be proportioned, and he will be sure of finding a manifold return for the expence.

If he will give his crop three horsehoeings, they are to be conducted in this manner.

The first must be a few days after the handhoeing of the partitions; and the two others at equally distant times between that and the beginning to pod.

The first is to be performed very deep, and in the middle of the large interval; and the two following must be more shallow, and be carried in the middle way between the first furrow and the rows.

Few

Few will be at the expence of repeated horsehoeings on a piece of pease, without seeing the advantage thoroughly explained, but that is in itself so clear and evident, when the whole compass of the work is taken in; and the benefit to the crop considered, that we shall be able to shew every thinking husbandman it is to his real and great profit.

Two points are intended by the sowing of pease; the one to get a profitable crop; the other to prepare the land for corn. Both will be answered by this method. His crop will have the advantage of so much nourishment, as could not be given to it any other way; the produce will be great accordingly; and at the same time the land will be prepared for wheat by such repeated plowings so finely, that there is no method whatsoever of making it so rich, or dressing it so well for that grain.

Reaping of pease.

Pease being come to their growth, are to be watched for the time of gathering. For it is of importance that the due ripeness be observed. In the plantation of garden pease in the field, the common method of pulling them as they ripen is to be followed; but in the farmer's concern, where they are not of that kind, nor intended for that use, they must be reaped at once.

In gathering by hand women are to be employed: they are to be sent into the field daily, to gather as the pods successively ripen, so that the profit rises daily; and it is to be begun as soon as any are fit to pull, and continued as long as there are any in a condition for service. For this there needs no particular farther direction.

In the farmer's pea field let all care be taken in examining the pease, from the time the pods begin to swell. From this period till their ripening, which is known by the size and firmness of the pea, the owner himself should every day go into several parts of the field, and open pods in different places.

All will not ripen together upon any ground, but he will thus know when most are ripe.

He will lose some by shedding, and some will be unripe at whatever time he reaps them, but he is to contrive so as to lose the least he can by one or other of these accidents. It is better to err on the side of their being under ripe than the other; because those which are but moderately ripened,

will harden in drying; whereas, when the field in general is too ripe, a great deal will be lost by shedding.

The best method of reaping is by a hook with a good edge, fastened to a long handle. A dextrous fellow will do a great deal of business in a day with this instrument, in a field of pease sown in the common manner; but in one planted regularly, the same hand will go through such a quantity as is surprising.

When the pease are cut down, leave them to dry a little upon the ground; but when they lie in a scattered manner there is more harm than good done by this.

The reaper should throw them up in small heaps, as he cuts them.

Nothing is so easy as tossing them on an heap, as they are cut with the long hook; and this should be done in so careful a manner, that the heap may lie hollow and light: this gives the wind free play among them; and if rain happens, they are in the less danger of being spoiled.

When they have lain till the stalks and pods are dried, they are to be carried in, and that should be done with care and discretion, that too much be not lost in the shaking.

Of Tares.

The tare is a low climbing or drooping plant, resembling the pea in growth, but smaller. The stalks are weak, and lean on the ground. The leaves are composed of several pairs of smarr, of a pale green colour, and there are tendrils for climbing or hanging upon any thing. The flower resembles that of the pea, but is smaller, and of a mixed purple colour in the common kinds, tho' of various hues, in others. The seeds are contained in slender pods, and are round and small. Their colour varies like that of the flowers.

There are two kinds of tares, the white and the black. These are named from the colour of the seeds, and have little other difference: they are only seminal varieties: the white tares rising originally from the seed of the black, as the common blue and red flowers of many kinds in our gardens, will occasionally yield such as are white. In the same manner the first variation in this kind of tare is, that the flower is white, whereas it is purple in the other; and the seeds afterwards are of the same white colour.

Either of these may be sown in fields, but the common or black tare is the hardier kind, and the best bearer.

There may be a great advantage in sowing tares, among the variety of articles with which the present practice of husbandry gives the farmer an opportunity of varying his crops. They excellently prepare the land for corn, and their produce is of a certain and not inconsiderable price, being the food of pigeons, and useful to many other purposes.

We have shewn the profits of a dove-cote: wherever there are pigeons, there must be tares raised or bought; and this is not their only use: the straw, when well dried, is an excellent food for cattle. So that upon the whole, the tare, though greatly inferior to many of the preceding articles, yet is a profitable, and very useful crop.

Of the soils for tares, and the management of the ground.

If the tare required a very rich soil, or great preparation, it would not be worth his while to raise it; but this is not the case: a very poor land will support it; and it demands little preparation.

It is a hardy product, approaching to the nature of a weed; and will therefore grow either on land naturally poor, or such as is exhausted: this is what makes the farmer find his principal advantage in its culture: for it not only thus stands in the place of barrenness, but prepares the ground for better crops.

Although most soils will do for the tare, yet there are some that it affects more than others. The variety of articles of late years introduced into the farmers profession, give him an opportunity of often varying the crop; and among these inferior kinds, he will find a double advantage in a prudent choice, which is most shewn in suiting the species to the soil.

The most favourable land for tares is a good sandy loam. They will succeed excellently on mellow earth, if not too moist for them: they will grow very well on sandy ground, that is not rich in any respect; and we see great crops of them in the lime-stone countries, and that frequently where there is very little depth of soil.

The worst ground for the tare is a tough wet clayey soil. In Hertfordshire, where a great quantity are raised, they find them always succeed better on the hilly grounds than in the vales.

The soil being fixed upon, there requires little care in making it ready for the seed. We do not mean to tie the farmer

farmer down so strictly, as that nothing will do but such a field as we have described, but when it happens he has the choice of two or three, and one of them answers this character better than another, he should take the best.

We will suppose the field where they are to stand, has been exhausted by the last crop of corn. In this case no preparation by manure, or repeated tillage is wanted: all that is needful is to plow in the stubble; and let this lie to rot; and in spring to open the ground for the tares; these crops are so far from demanding manure, that they serve as manure to the land themselves; and of them all none more than this species.

Of the sowing tares.

When the land is ready, the next thing is to take care of the seed: in this the husbandman should not be negligent: the care costs nothing, and it ensures a profitable crop.

Let the seed tares be purchased from some farmer, at ten or twelve miles distant. The advantage of this, in all seeds, has been shewn already; and let the farmer purchase such as have grown on a different soil from his own.

If his field be mellow earth, let him chuse the seed tares from a loamy or sandy soil; and if his be sandy, let him chuse the seeds from one that is not.

Those tares are best for sowing that are of a middling size, round, full, and plump, of a smooth and bright surface, and heavy. Few seeds are so apt to spoil.

The tare does not grow well unless it have been full ripe when gathered; and if it have suffered wet in the keeping, it loses a great deal of its vegetative power. These are the two accidents to fear, and he will be guarded against them by the rules we have given for his choice. Such tares as have been gathered before ripe, never get that roundness, fullness, or weight we have recommended, and if they have been damp, they lose their glossy surface, and do not recover it again.

The quantity is next to be considered; and in this the common practice comes nearer what is right, than in most other seeds. The general error is sowing too much, and what mistake there is, is on the same side here, but 'tis not great: five pecks are generally allowed to the acre, but a bushel is fully sufficient: three pecks will usually do very well.

The best time for sowing is in the middle of February. little trouble need be taken about them, for the most slight stirring of the ground is sufficient; but of one thing the husbandman must take especial care; which is, the finishing what he undertakes in this way without delay. There must never be more sown in a day than can be well covered before evening; for if they lie exposed to the dews of the night, they contract a damp that decays a great part of them; and the rest grow poorly.

In general, a somewhat poorer soil is better than a more rich land for tares. In the former they pod well; in the latter, they are to run into stalk and leaf with less bearing. There is also another misfortune attending the sowing of tares on rich land, especially if it be moist, which is, they are more apt to lie upon the ground because of the weight of the stalk, and then they rot.

There is an old custom among the farmers of Essex, of sowing tares and horse beans together: they thrive tolerably well this way, but they do better singly. There is no difficulty attending the reaping of them, for they may be very well cut together, when ripe, which will be about the same time; and the different sizes of the bean and tare make them easily separated in the barn by a riddle.

Of mowing and reaping of tares.

The crop being in the ground will require no farther care, for they shoot quickly, and grow vigorously, so that weeds do not thrive among them. There are two seasons of cutting them, the one for the food of cattle, the other for seed.

The first may be continued at different times for several weeks, and it is a wholesome and profitable food; the other is only to be done at one period, that is, when the tares are ripe in the pods; and for knowing this, the tare is to be watched as the pea.

The cutting them for fodder is often the most important service they can be put to; as to the letting them stand for ripening, it is for seed, or for food for pigeons.

Tares will be fit to cut in May for foddering cattle in the rack; and upon occasion, they may before that time serve for feeding fresh in the field.

The great advantage of these crops of ordinary pulse is, that they cover and shade the ground. The tare being larger than some of the others, serves this purpose better than they, and its seeds being of use, is another advantage, because it may

may be kept longer upon the ground. For this reason, though the farmer may occasionally cut his tares green, I advise him when he would give the ground the greatest advantage from them, to let the whole crop stand till ripe. In this case the entire field is covered for a very considerable time, there are no weeds suffered to grow in it, and the whole is mellow'd by lying under the stems and leaves of the tares, while their roots draw but little nourishment to impoverish it. The tares being then observed from time to time, as they ripen, are to be reaped when they are fullest in the pods; and then left to dry in the field in little heaps, before they are carried home, for getting out the seed.

Of preserving of tares.

Tares are damaged by wet, growing mouldy, or musty; and after this they never recover their right condition, look or value: there is another accident to which they are liable, that is, the being infected with worms, mites, and other little vermin. In this case the pulpy part is eaten, and they become light, dusty, imperfect, and of little value.

The preservation of tares from both these accidents, depends on the drying of them; for, as it is damp that moulds them, the same makes way for those little mischievous vermin: they are always found in damp tares, but rarely in such as have been properly dried.

We have directed their lying some days in the field, to dry. After this, when the tares are got out, they must be managed according to the weather.

If the air be warm and dry, spreading and turning them on a floor for some days, will answer the purpose; if otherwise, they should be laid upon a kiln: but, in this case the heat must be very gentle, and well moderated, otherwise it may do more harm than the damp; destroying the vegetative power in the seed, and injuring it in its nourishing quality.

When the tares are properly ordered, they must be kept in a dry place, and properly secured from vermin. The thorough drying is very essential, for otherwise they will breed disorders in the pigeons that are fed with them; and when used as seed, not one in ten will grow.

When they are to be kept any long time, the best way is to put them up in large barrels; then setting them in a dry, cool place, they will be out of all danger whatsoever. I have known tares thus kept that were good for all purposes.

fourteen years after the threshing ; and they probably would have kept as much longer.

The thetch, fetch, or vetch.

Few occupations among the common part of mankind, give origin to so many strange terms as the husbandman's. We have been careful to explain them in the course of this work ; and, we hope, by that means have rendered not only our own, but the writings of others more useful : the subject of the present chapter is an instance. We see in most books of husbandry written of late time, the name of the thetch, a plant recommended extreamly for the improvement of land. This is a kind of pulse very well known by its appearance, and by the shape of the seed, in the countries where it is customarily raised : but how is the farmer in a remote part of the kingdom, who wishes to bring home the improvements practised in other places, to know what is meant by the name ? No dictionary will explain it to him, for there is no such word in the English language. If he look into the English herbals, he will not find it in any of their indexes ; nay, though some of them have a particular table of barbarous words, as they are called, thetch is not among them. The reason is, that it is a barbarism of later origin than their time.

In some of the books wherein thetches are named, he finds them also called fetches, but this is a word as arbitrary and unmeaning as the former, there being no such properly in the language. In some it is, as they apprehend, farther explained by being written vetches : but this is a term that has worse consequences, for it creates confusion. There is such a word as vetch in the language, but it is the English of the word *Vicia* in Latin, and therefore signifies the tare.

In the two other cases, these writers use words that cannot be understood, because they have no received meaning at all ; and, in the latter, they use one that means something else.

If the farmer in a remote part of the kingdom, should from reading any of these popular works, be induced to propagate the thetch, he could never find any meaning of that word except the tare ; and he would therefore, after a great deal of difficulty, find what they did not mean. Themselves know what they intended by it, because a word will signify any thing that custom appoints ; but one purpose of this work

work being to convey to the farmer of one county, the knowledge of another ; we must make them understand each other's language.

There is a plant of the pulse kind very frequent in the warmer parts of Europe, the flower of which resembles that of the field pea, but its pod is short, and seems blown up. They call it in Latin Cicer, and its proper name in English is the Chich. Some have called it the Chich pea, others the Chich vetch ; and in speaking of the seed, the common expression is chiches. When the Chich first was brought into use among the English farmers, the name puzzled them ; and as they were accustomed to hear it spoken in the plural number chiches, they by one mispronunciation after another, called it cheches, thetches, fetches, and vetches.

This then is the pulse the writers on husbandry mean by the thetch, and under these names of Chich and Cicer, it will be found in the writings of those who have treated of plants.

The chich, or thetch, is of the pulse kind, but singular in the shape of its pods. We shall first make the reader properly acquainted with its nature, and its several kinds, and afterwards with the most advantageous manner of cultivating it.

Of the nature of the Chich, and its kinds.

The Chich is a weak and straggling plant. The root does not penetrate deep, nor spread far, so that the ground is not impoverished by it as by other growths. The stalks are numerous and weak, they will grow in the larger kinds, three foot long ; in the lesser two foot ; but always lie upon the ground. This is far from a disadvantage to the farmer, for by thus lying upon the surface, they cover it the more perfectly ; and make it light and hollow.

The leaves resemble those of the pea and tare, but they are more beautiful. Each is composed of three or four pair of lesser, and an odd one at the end, and these are all of a pleasant green, and notched round the edges. The flowers grow from the bottoms of the leaves, and are of the shape of those of the pea or tare, but small. They vary in colour according to the kinds, being white, red, or dusky, and the seed is of the same colour, which follows them. The pods that come after the flowers are of the same general structure with these of the pea kind, but they are short, thick, and blown up as it were, and each contains only one

or two seeds. These are not altogether round, but of a pointed shape in one part; from whence fanciful people have supposed they resembled the head of a ram, and the plant has been called the ram Chich.

The Chich is a native of Italy, and several varieties of it are cultivated in the gardens of that kingdom; as also of Spain, and Portugal, and in the south of France. They raise them as we do pease, and for their tables; whence their gardeners, as ingenious as ours, have made innumerable varieties. We are writing for the farmer, and he is to raise them for a very different purpose: all the distinction he need regard is, that of the two kinds which from their size are called the larger and the smaller Chich, and from the seasons of sowing them, the winter and the summer Chich, or thetch, the larger one is the winter Chich, for being more hardy it stands the cold; and the smaller one being tender, must be sown in spring.

The kinds cultivated in gardens abroad are principally three, the white, the black, and the red Chich; they are called by these names according to the colour of their flower and seeds, and are not there preferred to pease, but found better suited to the countries. Our pea is vastly preferable, according to the accounts of the Italians themselves, both in its taste and bearing, but it will not thrive so well with them as here; and these being natural to the climate, are cultivated in a great measure in its stead. The English farmer is to count little upon the fruit of this pulse more than for seed: therefore he is to see it in a proper light altogether different from theirs. With him it answers two purposes, the feeding his cattle in the stalk, not seed; and the enriching of the ground.

This enriching of the soil depends partly upon the keeping it clear of weeds, partly upon the little nourishment the plant requires, and partly upon the covering and shelter it gives the surface.

This last is the greatest consideration; for, when a piece of ground is lightly, but thoroughly covered, and little exhausted, it grows mellow, and becomes with little farther expence, fit for the richest crops. For this reason the large Chich is to be prefer'd to the other, as better covering the ground: but this is not all its advantage, for being sown in autumn, it provides an early food for cattle when they most want it.

Notwithstanding this, the farmer will find many particular circum-

circumstances wherein the small or summer Chich is preferable, with respect to the time of sowing, the nature of the provender, and the condition of the ground.

Of the proper soil for Chiches ; and its preparation.

The husbandman is to consider these little pulses in a very different respect from the valuable grains : the preparing the soil for them, lies in a very little compass, for they are rather sown to prepare the land for something else : but in the choice of the ground, there is a great deal to be considered.

He has a variety of these, the tare, the chich, and the lentil : they will all answer the same purpose to him, and they will thrive variously on different soils ; therefore he is to understand what kind suits each soil, that he may have the double advantage of enriching his ground, and increasing his crop. It is particular in these species, that the larger they grow, and the more they yield as fodder, the more and better they improve the ground for a succeeding crop.

As the tare loves a dry soil, the Chich will bear one that is somewhat damp. It is a proverbial saying among husbandmen, no rain will kill a thetch, and the same quality of bearing heavy showers while young, for that is the season of them, will render it capable of living in a soil naturally chilled by wet : but this must not be carried too far. Chiches will not live on a bog. In all things there must be moderation.

The best soil is a soft mellow earth : it will thrive excellently upon a rich field of this kind after barley or other corn.

Such a soil might be excellent for tares, but there may be accidents wherein it would fail for that crop, and yet notwithstanding which, it would be fit for the Chich. If a mellow soil be upon a hard gravel, that will excellently serve for tares, because the wet which falls will get through the lower bed, after it has done its office to the roots of the plants ; if a mellow earth have a bed of clay under it, tares will not grow upon it, because the clay holds the water too much, will chill their roots, and make the plants poor and yellow. Such a piece of ground as this will do excellently for chiches ; indeed, better than any other : this is a difference the farmer should remark carefully ; one of these soils will do for one, the other for the other crop ; and he who if he had sowed without consideration, might have had very

very indifferent crops of both, will, by thus examining the soil, and suiting the pulse to it, have very good ones from both.

After a rich mellow earth, the best ground for the Chich is a stiff loam.

Loams may be considered as soils of quite different qualities, according to the various compositions of the mixture. All of them have some sand and some clay: but when the sand is in the greatest quantity, they are loose and warm soils; where the clay, they are stiff and binding. In the former case their dryness and warmth make them very fit for the tare; and, in the latter, their stiffness and binding quality retaining moisture, make them suit the Chich.

Proper soils being chosen, there is little trouble in preparing them, but some difference in the manner of working when the seed is to be let in, according to the nature of the ground.

All that is required for these crops when they follow corn, is to plow in the stubble: this soon rots, and is all the manure that need be allowed them, the ground will be in sufficient heart to produce them.

Of sowing chiches.

These lesser pulses are very well produced in a year of fallow; and when eaten upon the ground, they give the land, by means of the dung and urine of the cattle, a very good dressing.

The winter Chech, is to be sown the first week in October, and will get a good root, and a strong head, and be able to stand against the frosts: when spring comes, it will push so vigorously, as very soon to be in a condition for eating on the ground; or mowing for that purpose.

The summer thetch, should be sown in the middle of February. The rains that naturally follow, push it up in the shoot, so that in a favourable time it will be ready for cutting in the end of May, or very well in the beginning of June, and may be eaten upon the ground sooner. The winter thetch, if sown early in October, will be so well grown by Lady Day, that sheep and lambs may be fed upon it.

The next thing to be considered, is the choice of seed; and after what we have said of tares, a few words will give the necessary information in all pulse: the danger is, that there are vermin, and that there have been damps; this may be discovered by the dead look, or the dusty appearance of the seed; and, in either case, that is to be rejected. Let the

the farmer chuse such as is bright, weighty and free from dust, and he will not be disappointed.

The quantity would come next, but in this, as the manner of sowing, suited to different soils; make some variation, that must be explained first.

If the soil be clayey, or of a stiff loam, the manner of sowing must be this. The ground must be broke with the common wheel plow, and the seed scattered in by hand in that manner the farmers call spraining of it, in ridges. It is thus to be plow'd in; and after this, the land is to be harrowed even, only leaving water furrows between the ridges.

In this manner accidents are prevented: none of the seeds are left exposed to the dews of the night, which would have very bad consequences.

When the soil is a mellow earth, with a proper bottom, I shall advise the farmer to sow his chiches in broad lands, with a single plowing, harrowing them well in.

The use of the crop is also to be considered before the sowing, that a proper method may be taken to prepare in time for it. Some are of opinion, that eating upon the ground is best; and others prefer the mowing and carrying off. This, when the land is of a middling nature, may make a difference in the manner of sowing; and when any one of these two methods are rendered necessary by the quality of the ground, the husbandman must conform to that necessity, rather than to the common opinions. When chiches are sown on ridges, they should be eaten upon the ground, because mowing is difficult; but when they are sowed in broad lands 'tis best to mow them.

Cattle tread down and destroy more than they eat, and the produce of one acre, carried to the rack, will go as far as that of two eaten upon the spot.

Sheep and lambs do less damage than such cattle as have broader feet; and their dung and urine, and the moisture from their bodies where they lie, gives a richness to the ground that may make amends: but this is not the case with horses. In wet seasons they cannot be turned in; at best they destroy a great deal by their heavy feet, and they can come upon the ground but once; whereas the same crop may very well be eaten twice by sheep and lambs in spring.

The proportion of the seed varies, when sown on ridges, after wheat or barley, two bushels and a half of the large will be a proper allowance to the acre; and of the small
three

three bushels. When it is sown in broad lands three bushels of the large, and two and a half of the small, is the proper allowance.

In other crops we depend upon their produce in the grain, therefore a few plants well nourished is what we should aim at; but here the farmer does not form his expectations of any such crop. Two points are to be obtained by the chiche, covering and mellowing the ground; and supplying cattle with food. Both these will be best answered by the chiche growing close.

Of the management of chiches, and their standing for seed.

Whether it be in autumn or spring the chiche is sown, it requires no farther care from the owner, after it is harrowed into the ground: it will rise quickly, and shoot strongly; and being sown thick will destroy all the weeds that shall attempt to rise among it. In either case he is to leave the whole to nature and wait her progress, observing the growth from time to time, to find when it becomes fit for being eaten: in this he is to consider also the condition of his stock, and their other provender; for he may find it profitable to turn in his sheep and lambs a week or two before he could wish, for the sake of the chiches, when they would else decline for want of proper food.

The winter chiche comes in earlier than the spring kind, but the latter is the wholesomest food for lambs.

This does not cover the ground so well as the larger, nor yield so good a crop of stalks and leaves; but there are advantages. It is best for the smaller-cattle, and it grows up much sooner after cropping than the other.

The winter thetch succeed best on broad land, and the small on ridges. I name this the more punctually, because in this county (Middlesex) the custom is the contrary method in most cases. The large thetch is best for mowing, and the smaller for eating on the spot; and this is a farther reason why the small should be sowed preferably on ridges.

We have observed what necessary difference the nature of soils may make; we speak here of what is best when the choice on that account is indifferent.

As to the use of chiches the standing for seed is the least, yet it is needful some seeds should be saved, and therefore some care must be taken about it. The farmer should prepare for this in time, by properly looking forward.

If he have sown two fields with chiche, that which is dryest is the most proper for seed; if only one, he should see which is the warmest part of it. In either case he must set aside such a piece as is convenient for seed, keeping cattle off by fencing, or if horses by staking them down.

He will find his account in considering this at the time of sowing.

Let him, when he orders his field to be plowed up for this purpose, shew the seedsman the spot he fixes upon for letting a crop stand for seed, and order him to strew the chiches there more sparingly. Half the usual quantity will be sufficient for this spot, and he will get more seed, and better than if he allowed the whole. He will soon see the difference in the growth of the plants; and it will be proper to have this small part where they are set for seed once weeded.

These are to stand undisturbed till the chiches are thoroughly ripe in the pods; and then are to be reaped together and threshed, after a gentle drying.

The seed is to be spread upon a floor and dried. It will be adviseable for the owner to exchange this with some distant farmer, rather than sow it again himself; but he will see by the look and condition of his own, when thus cur'd, how the other ought to look when good.

Of the manner of feeding with chiches.

Part being set aside for seed, the farmer is to consider the rest as food of his stock, and to contrive for spending it among them. There are three ways of using it: first, by turning in of cattle: secondly, by cutting it green for them: and thirdly, by making it into hay.

Cattle are fondest of it when they eat it upon the ground: it is the most profitable when mowed green, and given them in racks; but it is the most wholesome when dried. In this state cattle relish it very well, and according to its condition will prefer it to other foods. The larger it is, the coarser hay it makes, the smaller the finer and more tender.

The little chiche makes the best hay; but the large kind, when not too rank, answers very well.

The husbandman should cut at proper times and in proper quantities, and consider that the value depends on the age and kind; he will therefore allow the proper portions for feeding, and will take his opportunities of cutting and drying
some

some of the best and choicest, when it is of such a growth as will render it most agreeable.

His consideration may extend beyond the common consideration of the growth. He may recollect at what time it will be useful to give his lambs a feeding of the fine young shoot of the thetch, and cut some of the best parts of the ground accordingly. The plants will grow up a great deal quicker when they have been mowed, than when they have been gnawed in eating; and he will have here a second spring, wherein there will be tender, delicate, and wholesome food for the lambs, at a time when he could not have got it in the same condition any where else.

When chiches have been thus managed, during summer, the owner will find he has made a very good use of his field, but the greatest advantage is behind, for his land which was before in such an exhausted condition, as to require the refreshment of a fallow, has all the time it was nourishing this useful crop been getting into heart.

He has his choice of wheat or turnips in the first place, and if he disapprove these, of almost any other kind.

When a good piece of ground has been covered with a crop of chiches, it will, by Michaelmas, be so mellow and fine, that he may sow wheat upon it with great success.

If he chuse turnips, they may be sown with one plowing, and there will be no reason to fear an early and a profitable crop.

We have mentioned the principal corns and growths among which the husbandman may take his choice; and we shall hereafter treat of coleseed. Few things are more profitable, under good management; and it never comes better than after a good crop of chiches.

The winter chiche is most profitable, because of its coming early, when there is a scarcity of other food; and it covers land the best: but it is proper we add what there is against it.

The disadvantage of the winter chiche, is the uncertainty of the crop; for it sometimes perishes by frost. It often fails even in February, or the first week in March, by the severity of frosts that come after hot days.

The spring sowing is always safe; and as the severe weather in February will often check those crops, which it does not destroy, these coming up quick, and meeting no stop, overtake them.

There

There is no better food for the horse than fresh mown chiches, he will eat them freely: they take at first the common effect of green food in a kindly manner; after which nothing puts him better in flesh.

It is of the same advantage in fattening of horned cattle; and is in a particular manner suited to cows, because at the same time that it fattens them up, it makes them yield a large quantity of milk, and does not give it that ill flavour which it gets from the feeding on some of the artificial grasses.

Ewes, while they feed on it, have the same advantage, fattening themselves while they supply their lambs.

Of lentils.

Lentil is another of the small pulse, which has not been sufficiently known in the early practice of husbandry: we shall endeavour to render it more universal.

Farmers, in those countries where this pulse is propagated, call it the till or tills.

The lentil agrees with the chiche, because it has a short pod: but not so blown up as that, nor have the seeds that remarkable figure, by which those of the chiche resemble the head of a ram.

The lentil is the smallest of the pulse kind. Its root is little, and its stalks numerous and spreading, so that it covers the ground well, and draws little nourishment, improving the land; but in a manner inferior to the chiche, because it is smaller.

The stalks of the lentil are a foot and a half long but weak, the leaves are composed of several pairs of small ones, and are of a pale green; they differ from those of the chiche in that they have no odd one at the end; for there is a tendrill in that part.

The flowers are little and redish, sometimes of a deep purple, and sometimes white: the pods are small, and there are usually two seeds in each.

The lentil may be eaten upon the ground or in the rack, and is good green or dry. Lentils are a good food for horses, fattening them and keeping them in health. Sometimes when eaten greedily green they throw them into disorders, but this may be prevented by giving them in a proper manner. The best way of horses eating them is dry. They are also good for cows, sheep, and hogs; for the former in the leaf, and for the other when in fruit. They require no
care

care after they are in the ground, and very little charge in getting them into it.

Of the proper soil for lentils, and the manner of sowing them.

There is an advantage to the husbandman, in crops that grow upon poor land; the lentil is one. The chiche will thrive upon ground that has been exhausted by corn; but the lentil will succeed on such as is naturally poor, and has been also exhausted.

The lentil thrives upon sandy, gravelly, or chalky soils; it is not under that necessity of wet the chiche is, but will come to good where there is but the least fund of nourishment. In the poorest, hungriest loams the lentil yields a large crop: and never fails to leave that or any other land in a much better condition than before.

Land requires little preparation for lentils: they are to be sown in spring. The middle of March is a proper time; and the end of that month, or the beginning of April, will do very well.

This pulse is so small it does not well cover the ground, for which reason it does not enrich it like the other kinds: it may be sown with oats or barley. Oats and lentils will be ripe about the same time, and may be reaped, and threshed together, after which they will easily be separated by throwing: the oats being lightest will fly farthest, and the lentils from their weight, and their smooth round form, which the air lays less hold of, will drop by the way.

When they are sown with barley they may be separated in the same manner; and if care be taken in the throwing, there will be little farther trouble.

Seed lentils should be plump, smooth, and shining: and the farmer will do well to exchange seed with some other, who occupies a different land. According to the service, a different manner of sowing will be proper. It is useful to be eaten in the stalk, but it is also worth regard as to the seed. It is preferable to the chiche, because the pods are more numerous, and the seeds are not only produced in greater quantity, but are more valuable.

The covering of the ground being less a consideration, gives a new method of culture for this species, that is, by the drill and horsehoeing method. The lentil will thrive on the poorest ground; but we shall advise the farmer, on some occasions, to prefer better.

Let

Let him consider what is the principal use for it. If he design it for eating, let him sow it in the common way, as we have directed with respect to chiches; but if he have his eye principally on the seed, let him sow it by the drill, in such manner that it may be horsehoed.

This infers a great difference in the quantity of seed.

When lentils are sown for feeding, the proper quantity is a bushel and a half to an acre: if intended for seed, and sown by the drill, three pecks is a sufficient quantity.

The best time for sowing them is the third week in March, and they should be sown in double rows, with about eight inches between, and with such intervals, that the horsehoe may conveniently come in.

The produce will be very great; and this is the best way of sowing them on poor land.

Of the management and use of lentils.

The lentil, as sown in the common and drill way, requires to be spoken of distinctly. If it be sown by hand, nothing more need be done, for it will rise thick and destroy weeds. When it is sown by drill, the horsehoe must go once through the middle of each interval, when the first shoot is up; and then no more trouble is necessary. They are to stand till ripe, and then to be reaped and dried, by lying in little heaps in the field, and then threshed.

If they be sown in the common way with oats or barley, when ripe they must be threshed together; when they are sowed alone, in the common way, there requires care and conduct in the management of them.

Some are to be left to stand for seed, but the greater part is to be eaten.

Lentils will not grow up after eating, so free as the chiche, but they afford a good supply at the cutting. For all purposes the cutting and drying is the best method. The ox, cow, and horse are fond of the lentil dried, and it nourishes them greatly.

The best time for cutting it for oxen and cows, is when the pods begin to fill; but for horses it is best when the lentils are nearly ripe. It must not be let to stand till they are quite ripe, but just when the seed is large, and the leaves are not decayed.

When lentils and barley have grown together, they may be ground together, and will make a very wholesome kind of bread; being boiled in the manner of pease, they are

eatable: they are excellent in the straw, to make cows give abundance of milk, and they give it no ill taste; and there is no plant whatsoever that better assists the ewe for the suckling of her lambs.

Of buck-wheat.

Buck-wheat, called in some places brank, is very different in kind from the several plants before-named, but it is cultivated as an herb that may yield some profit, and at the same time improves the ground whereon it grows.

Buck-wheat is upright and grows a yard high, and has a stiff, firm, and round stalk, which divides toward the top into several branches. The leaves are broad, they are forked at the end next the stalk, and pointed at the other, and they are of a pale green, often yellowish. The flowers stand on the tops of the branches in large tufts; they are small and white, and the seed follows, which is of a triangular shape, large and brown on the outside, but with a white kernel within. Each flower of the buck-wheat consists of one white little leaf, divided into five parts, and has no cup. Within this are eight little redish lumps, which contain a sweet juice; these form what is called the nectarium of the flower. In the center there grow eight slender threads, of the length of the flower, with little buttons at their ends; among these stands the rudiment of the seed: this is of three square form, and has three thready substances growing to it, which are tufted at the ends: these serve to catch the dust from the little buttons, on the tops of the other threads for the ripening of the seed. One seed follows every flower, and the flower itself serves it as a covering, growing dry without falling, and clinging round it.

It is a native of the east, and is used in some parts for bread.

There are two uses in this crop, its seed is of some value, and it will serve as a manure; or as the farmers express it, a lay, whereon to sow wheat or rye; in this case nothing is so advantageous, as the plowing it in entire at a proper growth.

Of the soil for buck-wheat, and the manner of sowing it.

Buck-wheat will grow on the most barren lands, heathy land, or naked gravel, or in the stone countries, one of those

those lands where chips and fragments of stone make up, in a manner, the surface, buckwheat will grow on any of them. It requires little preparation, and needs not be sown till very late.

Chuse the fairest and soundest seed. Such as is dry and of a bright colour is best.

The quantity is to be different, according to the design of sowing. When buck-wheat is raised for seed, a small number of plants well nourished is what the farmer is to desire; but when it is sown to be plowed in as a manure, the larger a quantity there is upon the ground the better.

When buck-wheat is raised for seed a bushel is sufficient for an acre; but when it is meant by way of preparation for another crop, four bushels to the acre is not too much. The beginning of May is the earliest it should be put into the ground: the middle of that month is a better time, and it will do to the very latter end. Buck-wheat being a native of warm climates, does not bear cold; and it is so quick a grower that it needs not be sown early.

The common method of plowing and harrowing, and that in the lightest manner, covers it, and it will shoot at its own time, let the weather be what it will: rain or dry makes little difference.

When once up it grows apace. The sort of ground allowed to it does not favour the growth of weeds, nor do they grow quick upon it; so that the buck-wheat thriving apace, quickly gets the better of them.

Of the management and use of buck-wheat.

Beside the two uses of seed, and plowing into the ground, it has another, which is, being eaten by cattle. It comes in at a time when other provender is scarce, the grass being burnt up by the heat; and the horned cattle toward the end of summer, generally in great want of good fresh food. Buck wheat being then just coming into blossom, the cows are very fond of it; and it is an excellent nourishment, rich and wholesome, making them yield a great quantity of milk, and not giving it any disagreeable taste. There is no better butter or cheese, than such as is made of their milk when they have fed in this manner.

If the farmer intends his crop for this use, he must sow it thick, but not so thick as when he intends it for plowing in; two bushels and a half of seed to an acre will yield a very good growth for this purpose.

After the cows have eaten it down, the stubble may be plowed in, and the land will do very well for a crop of rye. When it is to be sowed in entire, the crop is to stand till full grown and in flower, but not till the seed is formed. Just before that it is in the richest condition for manure, and that opportunity is to be taken.

When the seed is the point in view, and the field has been sown sparingly for that purpose, the plant will be much stronger, and they will ripen a great deal.

The farmer is to watch when most is ripe and none fallen, and then he is to get in his harvest.

Buck wheat may stand longer than almost any crop, for none holds the seed so firmly. But there is to be some regard to the ripeness; and when but little is left that can come to good, the whole is to be cut.

The way of gathering it is by mowing; and when down it is to lie some days in the air before it is housed; there is no great danger of accidents, for scarce any thing is so hardy. When the stalks are grown limber, and the grain firm, it is to be carried in and threshed. The produce is very great. Fifty bushels for an acre may be had from very moderate land, and much more is common from such as is any thing rich.

The uses of the seed are many, it serves excellently for hogs, who are fond of it and fatten very well upon it: many kinds of poultry also like it; and in some countries it is eaten by the poorer people, made into a kind of pancake, with some wheat flower among it. It is a thriving food for horses. But it should be broke in a mill before they have it, otherwise the skin is so tough it passes through them without doing any good. Cattle will also eat the straw, but it is not nearly so nourishing as the grain.

End of the SECOND VOLUME.



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